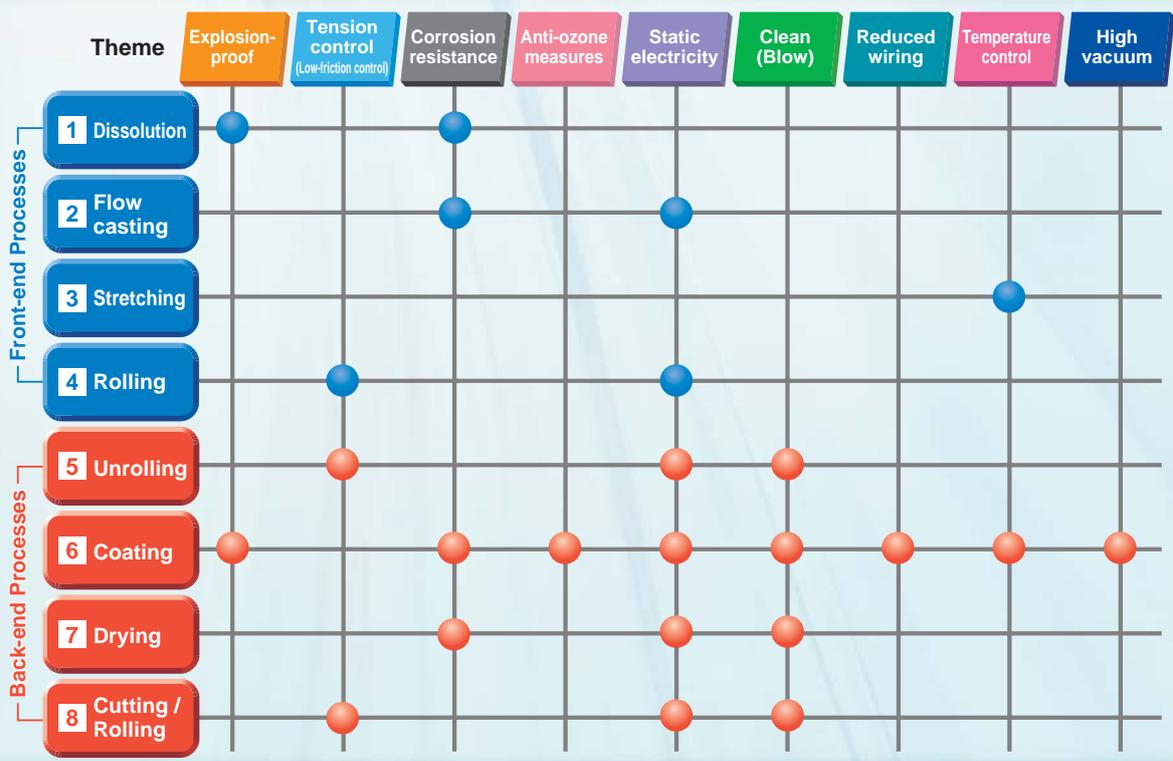


# Film Manufacturing Process Equipment



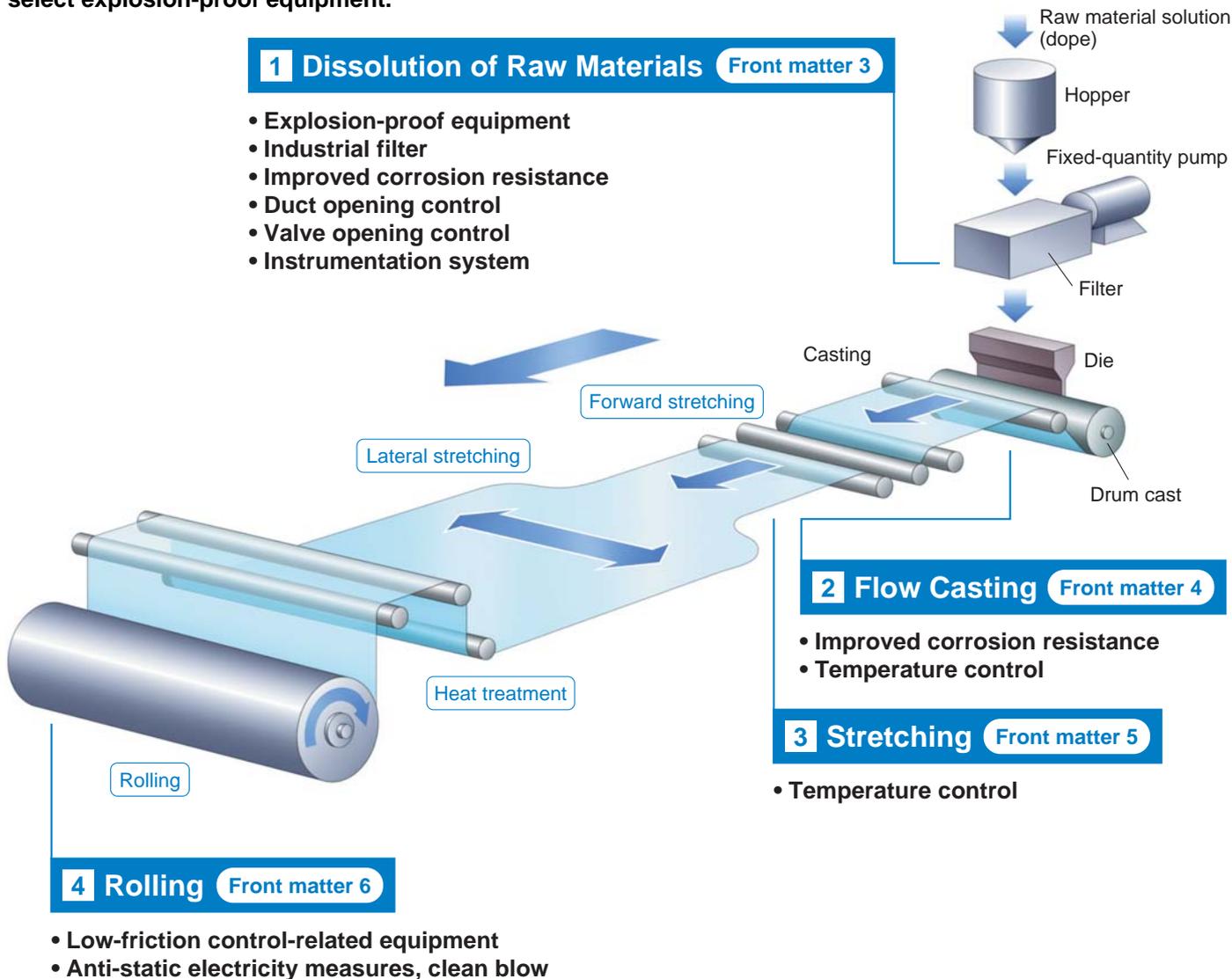
Film materials have a wide range of applications, from LCD and PDP optical film to food and medical products, etc. Manufacturing consists of a large number of processes including “**dissolution of raw materials**”, “**film base fabrication**”, “**solvent coating**”, “**rolling and unrolling**”, and others, each of which requires explosion-proof specifications, static electricity elimination and temperature control. This catalog introduces various product concepts and series, divided according to process category.

(The processes shown below are general examples, and product concepts and series are not limited to these processes. Please use them as a guideline when selecting the right equipment for your needs.)

## PET Film Example of Manufacturing Process

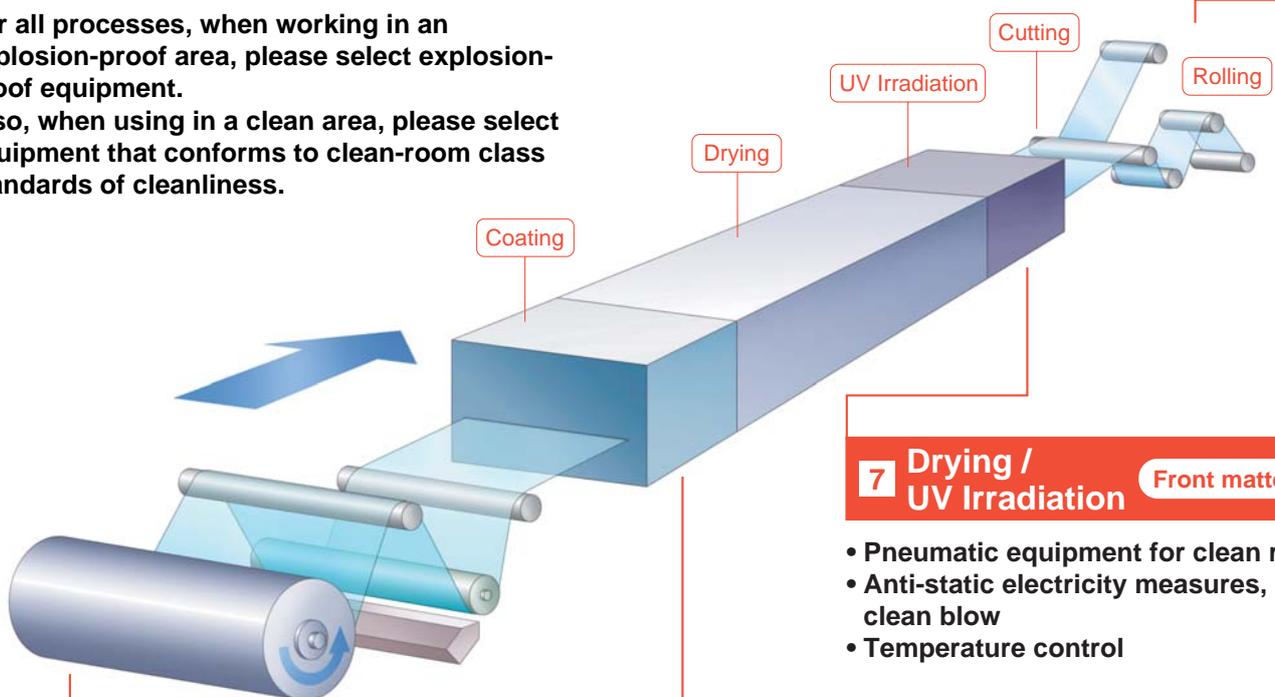
### Front-end Processes

For all processes, when working in an explosion-proof area, please select explosion-proof equipment.



## Back-end Processes

For all processes, when working in an explosion-proof area, please select explosion-proof equipment.  
Also, when using in a clean area, please select equipment that conforms to clean-room class standards of cleanliness.



### 5 Unrolling Front matter 7

- Low-friction control-related equipment
- Anti-static electricity measures, clean blow
- Pneumatic equipment for clean room

### 8 Cutting / Rolling Front matter 12

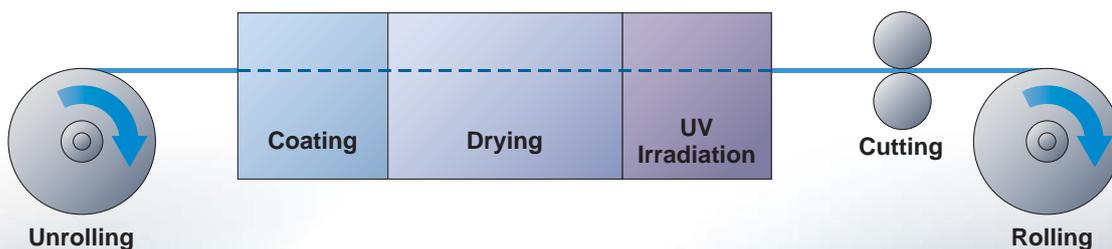
- Low-friction control-related equipment
- Anti-static electricity measures, clean blow
- Air levitation rail
- Non-contact pad
- Pneumatic equipment for clean room

### 7 Drying / UV Irradiation Front matter 11

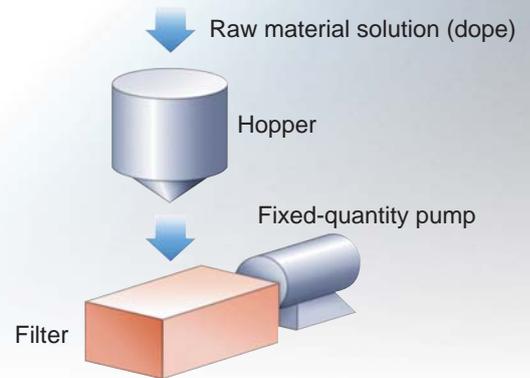
- Pneumatic equipment for clean room
- Anti-static electricity measures, clean blow
- Temperature control

### 6 Coating Front matter 9

- Explosion-proof equipment Diaphragm pump
- Anti-static electricity measures, clean blow
- Reduced-wiring system
- Pneumatic equipment for clean room
- Improved corrosion resistance
- Temperature control
- Measures based on corona discharge, etc.
- High vacuum valve



Dried chips of raw material (PET) are fed into a hopper, then supplied to an extruder and completely melted down.



## ● Blending of Raw Materials

### Explosion-proof equipment

Intrinsically Safe Explosion-proof System	
5 Port Solenoid Valve: 51-SY .....	P.2
Explosion-proof System Solenoid Valve:	
50-VFE/VPE .....	P.2
*5 Port Solenoid Valve: SY .....	P.2
*5 Port Solenoid Valve: VQC .....	P.2

\* Does not meet explosion-proof specifications. Please use only in non-explosion proof areas.

### Industrial filters

Industrial Filter: FG .....	P.21
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## ● Solvent Atmosphere

### Improved corrosion resistance

Stainless Steel Cylinder: CJ5-S/CG5-S .....	P.7
Floating Joint (Stainless Steel): JS .....	P.7
Stainless Steel 316 One-touch Fittings: KQG ..	P.10
Stainless Steel 316 Insert Fittings: KFG .....	P.10
Stainless Steel Speed Controller: ASG .....	P.7
FEP Tubing: TH/TIH .....	P.11
Fluororesin Tubing: TL/TIL .....	P.11
Clean Regulator: SRH .....	P.10

## ● Air-conditioning Duct Control ● Raw Material Quantity Control

### Duct opening control Valve opening control Instrumentation system

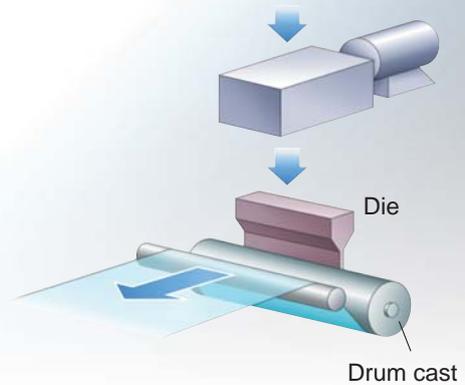
Electro-Pneumatic Positioner: IP8000/8100 .....	P.4
Precision Regulator: IR1000/2000/3000 .....	P.10



## Points and Precautions for Selection

- When using in an explosion-proof area, please select explosion-proof equipment.
- Please use a low-power-consumption solenoid valve if you plan to keep the solenoid valve energized for extended periods of time. Please refer to page 26 for details.
- Using equipment in a solvent atmosphere may result in diminished product quality, so please check the specifications and materials of the model.
- When using equipment at high temperatures or in a solvent atmosphere, please check the specifications (operating temperature, materials, etc.) of the model before using.

After casting in the direction of the axle using a die, a PET sheet is created by attaching to a cooling drum and solidifying it with rapid cooling.



### ● Solvent Atmosphere

#### Improved corrosion resistance

Stainless Steel Cylinder: CJ5-S/CG5-S .....	P.7
Floating Joint (Stainless Steel): JS .....	P.7
Stainless Steel 316 One-touch Fittings: KQG ...	P.10
Stainless Steel 316 Insert Fittings: KFG .....	P.10
Stainless Steel Speed Controller: ASG .....	P.7
FEP Tubing: TH/TIH .....	P.11
Fluororesin Tubing: TL/TIL .....	P.11

### ● Drum Cooling

#### Temperature control

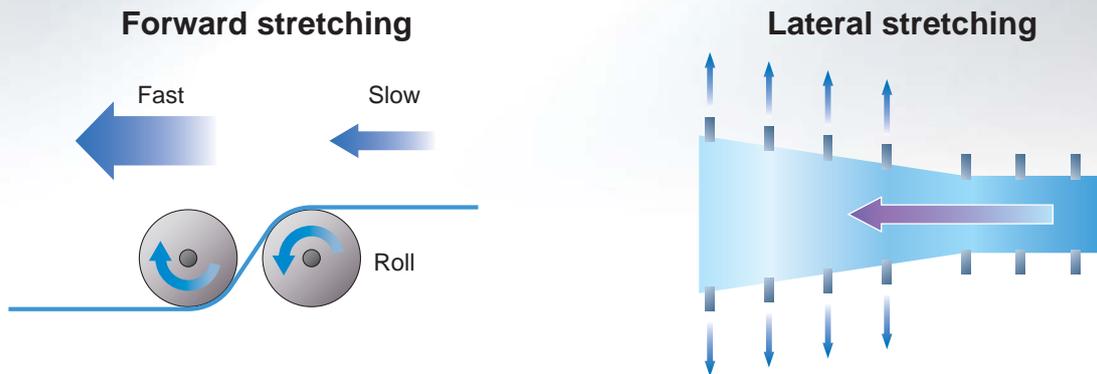
Thermo-cooler (Constant temperature water circulating device): HRG .....	P.18
Thermo-chiller (Constant temperature fluid circulating device <High performance type>): HRZ .....	P.18



## Points and Precautions for Selection

- When using in a clean area, please select equipment that conforms to clean-room class standards of cleanliness.
- Using equipment in a solvent atmosphere may result in diminished product quality, so please check the specifications and materials of the model.
- When using equipment at high temperatures or in a solvent atmosphere, please check the specifications (operating temperature, materials, etc.) of the model before using.

Stretch in a forward direction by changing the rolling speed, and stretch laterally in a high-temperature drying kiln.



### ● Rolling Temperature Control

#### Temperature control

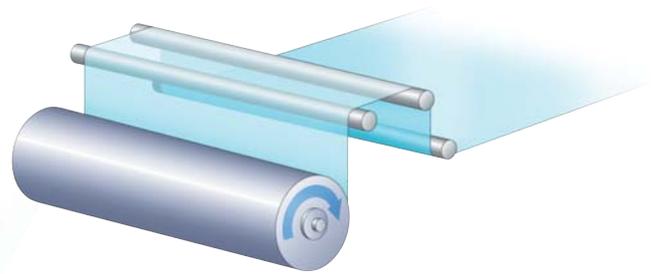
Thermo-cooler (Constant temperature water circulating device): HRG .....	P.18
Thermo-chiller (Constant temperature fluid circulating device <High performance type>): HRZ .....	P.18



### Points and Precautions for Selection

- When using the equipment in the vicinity of a heat source, please be sure to check the equipment specifications (operating temperature range).

Introduce several rolls, fix the dimensions and roll up the sheet.



Rolling

● Tension Control

Low-friction control-related equipment

Low Friction Cylinder (Metal seal type):	
MQQ/MQM .....	P.6
Smooth Cylinder:	
CQSY/CQ2Y/CM2Y/CG1Y/CA2Y .....	P.5
Compact Electro-pneumatic Regulator:	
ITV0000 .....	P.8
Electro-pneumatic Regulator:	
ITV1000/2000/3000 .....	P.9
Precision Regulator: IR1000/2000/3000 .....	P.10



Points and Precautions for Selection

- A low slide-resistance cylinder and a high-precision pressure control are necessary for tension control. Please use in combination with a low-friction type cylinder and precision regulator or electro-pneumatic regulator.

● Preventing Attachment of Foreign Objects

Anti-static electricity measures

Ionizer: IZS31 ..... P.12

Clean blow

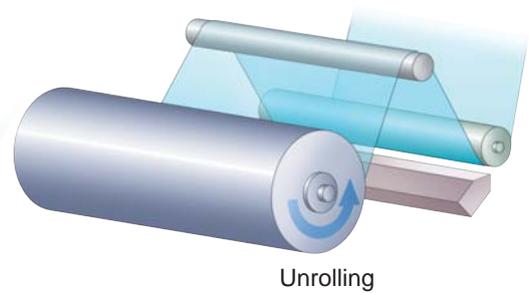
Clean Air Module (Made to Order): LLB2 ..... P.15



Points and Precautions for Selection

- Static electricity can cause various phenomena including adhesion or attachment of foreign objects when rolling. Please use an ionizer to eliminate static electricity.

Tension control is required at a constant level during unrolling.



## ● Tension Control

### Low-friction control-related equipment

Low Friction Cylinder (Metal seal type):	
MQQ/MQM .....	P.6
Smooth Cylinder:	
CQSY/CQ2Y/CM2Y/CG1Y/CA2Y .....	P.5
Compact Electro-pneumatic Regulator:	
ITV0000 .....	P.8
Electro-pneumatic Regulator:	
ITV1000/2000/3000 .....	P.9
Precision Regulator: IR1000/2000/3000 .....	P.10

## ● Preventing Attachment of Foreign Objects

## ● Improved Quality

### Anti-static electricity measures

Ionizer: IZS31 .....	P.12
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### Clean blow

Clean Air Module (Made to Order): LLB .....	P.15
Direct Operated 2 Port Solenoid Valve: VX2 ...	P.17
Direct Operated 2 Port Solenoid Valve for Air: VCA .....	P.17
Clean One-touch Fittings (for Blowing): KP□ ...	P.10
Polyolefin Tubing: TPH .....	P.11



## Points and Precautions for Selection

- A low slide-resistance cylinder and a high-precision pressure control are necessary for tension control. Please use in combination with a low-friction type cylinder and precision regulator or electro-pneumatic regulator.
- When using in a clean area, please select equipment that conforms to clean-room class standards of cleanliness.

## ● Clean Room Specifications

### Pneumatic equipment for clean room

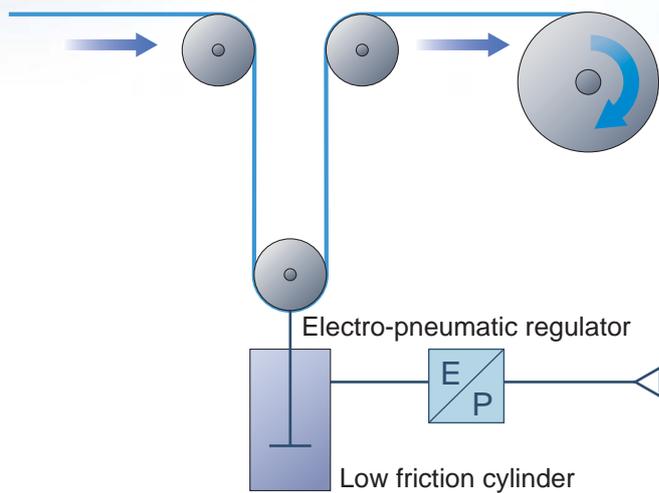
Clean Series .....	P.22
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## <Example of tension control during rolling and unrolling>

### ① Dancer roll control

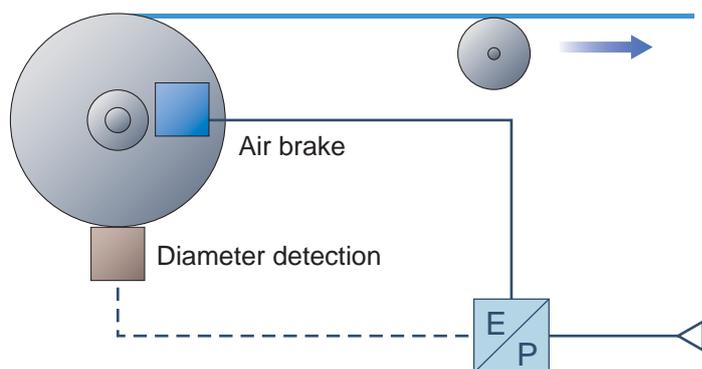
As the diameter of the roll increases, tension on the dancer roll decreases. (Drooping or straining of the film is corrected, and tensile force is maintained.)

A low friction cylinder, etc. with less mechanical loss is used.

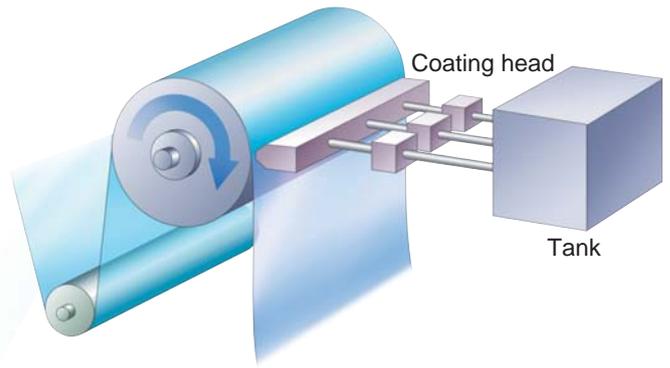


### ② Air brake control

The diameter is detected, deformation is reported to an electro-pneumatic converter, and the air brake is activated.



Film is coated with various types of solvents, depending on the application.



### ● Various Acidic and Alkaline Chemical Solution Atmospheres

#### Improved corrosion resistance

Air Operated Chemical Valve: LV .....	P.17
Fluoresin Fittings/Hyper Fitting: LQ1 .....	P.17
Fluoresin Fittings/Hyper Fitting Flare Type: LQ3 .....	P.17
Stainless Steel Cylinder: CJ5-S/CG5-S .....	P.7
Floating Joint (Stainless Steel): JS .....	P.7
Stainless Steel 316 One-touch Fittings: KQG .....	P.10
Stainless Steel 316 Insert Fittings: KFG .....	P.10
Stainless Steel Speed Controller: ASG .....	P.7
FEP Tubing: TH/TIH .....	P.11
Fluoresin Tubing: TL/TIL .....	P.11

### ● Solvent Transfer

#### Explosion-proof equipment

Intrinsically Safe Explosion-proof System	
5 Port Solenoid Valve: 51-SY .....	P.2
Pressure-resistant Explosion-proof System	
Solenoid Valve: 50-VFE/VPE .....	P.2
*5 Port Solenoid Valve: SY .....	P.2
*5 Port Solenoid Valve: VQC .....	P.2

\* For use in non-explosion proof areas

#### Diaphragm pump

Fluoresin Process Pump: PA/PAP .....	P.18
Process Pump: PAF .....	P.18

### ● Prepared Solution Sending Control

#### Reduced-wiring system

Serial Transmission System: EX120 .....	P.4
Serial Transmission System: EX510 .....	P.4
Manifold with SUP Stop Valve: SS5Y□-X460 .....	P.3

#### Explosion-proof equipment

Intrinsically Safe Explosion-proof System	
5 Port Solenoid Valve: 51-SY .....	P.2
Pressure-resistant Explosion-proof System	
Solenoid Valve: 50-VFE/VPE .....	P.2



### Points and Precautions for Selection

- Please use a low-power-consumption solenoid valve if you plan to keep the solenoid valve energized for extended periods of time. Please refer to page 26 for details.
- Using equipment in a solvent atmosphere may result in diminished product quality, so please check the specifications and materials of the model.
- When using equipment at high temperatures or in a solvent atmosphere, please check the specifications (operating temperature, materials, etc.) of the model.
- Through the use of a manifold with an SUP stop valve (refer to page 3), it is possible to replace equipment incrementally without causing an overall stop of the line, allowing for faster restarting of operation.
- When working in an explosion-proof area, please select explosion-proof equipment.
- When using in a clean environment, please select equipment that conforms to clean-room class standards of cleanliness.

## ● Temperature and Flow Control of Chemical Solutions

### Temperature control

Thermo-cooler (Constant temperature water circulating device): HRG ..... P.18

Thermo-chiller (Constant temperature fluid circulating device <High performance type>): HRZ ..... P.18

Flow Switch: PFM/PF2A/PF2W ..... P.16



#### Points and Precautions for Selection

- A stable and even coating is made possible by keeping the roll and the solvent at a constant temperature. A chiller allows for high-precision temperature control.

## ● Anti-ozone Measures

### Improved ozone resistance

Anti-ozone Equipment ..... P.27

## ● Deaeration Treatment

### High vacuum valve

Stainless Steel High Vacuum Angle Valve: XM ..... P.19

Stainless Steel High Vacuum In-line Valve: XY ..... P.19, 20

High Vacuum Straight Solenoid Valve: XSA .... P.20

## ● Clean Room Specifications

### Pneumatic equipment for clean room

Clean Series ..... P.22

## ● Preventing Attachment of Foreign Objects

### Anti-static electricity measures, clean blow

Ionizer: IZS31 ..... P.12

### Clean blow

Clean Air Module (Made to Order): LLB2 ..... P.15



#### Points and Precautions for Selection

- Peel-off during rolling and unrolling can cause static electricity-related phenomena such as adhesion or attachment of foreign objects. Please use an ionizer to eliminate static electricity.
- When using in a clean environment, please select equipment that conforms to clean-room class standards of cleanliness.

After drying and fixing the coating material to the film, UV irradiation is used to harden the surface.

● Clean Room Specifications

**Pneumatic equipment for clean room**

Clean Series ..... P.22

● Preventing Attachment of Foreign Objects

**Anti-static electricity measures, clean blow**

Ionizer: IZS31 ..... P.12

**Clean blow**

Clean Air Module (Made to Order): LLB2 ..... P.15



**Points and Precautions for Selection**

- High temperatures can cause a charge to build up, resulting in generation of static electricity. Please use an ionizer to prevent static electricity and the attachment or adhesion of foreign objects.
- When using in a clean environment, please select equipment that conforms to clean-room class standards of cleanliness.

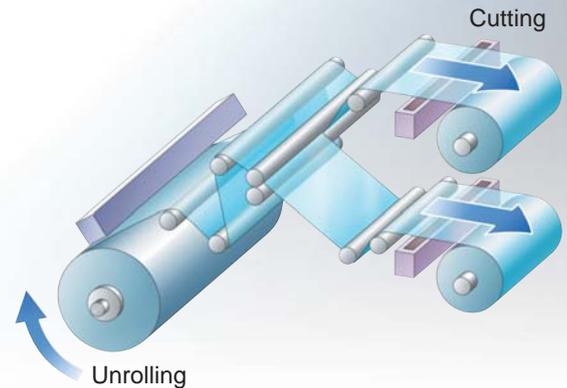
● Temperature Control of the UV Heat Source

**Temperature control**

Thermo-cooler (Constant temperature water circulating device): HRG ..... P.18

Thermo-chiller (Constant temperature fluid circulating device <High performance type>): HRZ ..... P.18

While continuing to unroll, the film is cut down the middle direction and rolled up at a constant level of tension.



### ● Tension Control

#### Low-friction control-related equipment

Low Friction Cylinder (Metal seal type): MQQ/MQM .....	P.6
Smooth Cylinder: CQSY/CQ2Y/CM2Y/CG1Y/CA2Y .....	P.5
Compact Electro-pneumatic Regulator: ITV0000 .....	P.8
Electro-pneumatic Regulator: ITV1000/2000/3000 .....	P.9
Precision Regulator: IR1000/2000/3000 .....	P.10

### ● Preventing Attachment of Foreign Objects

### ● Quality Improvement

#### Anti-static electricity measures

Ionizer: IZS31 .....	P.12
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#### Clean blow

Clean Air Module (Made to Order): LLB2 .....	P.15
Direct Operated 2 Port Solenoid Valve: VX2 .....	P.17
Direct Operated 2 Port Solenoid Valve for Air: VCA .....	P.17
Clean One-touch Fittings (for Blowing): KP .....	P.10
Polyolefin Tubing: TPH .....	P.11
Soft Polyolefin Tubing: TPS .....	P.11

### ● Clean Room Specifications

#### Pneumatic equipment for clean room

Clean Series .....	P.22
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### ● Quality Improvement

#### Air levitation rail Non-contact pad



## Points and Precautions for Selection

- A low slide-resistance cylinder and a high-precision pressure control are necessary for tension control. Please use in combination with a low-friction type cylinder, precision regulator and electro-pneumatic regulator.
- When selecting a cylinder for cutting, please choose a high-rigidity, high-precision cylinder with a guide.
- For better product performance, please use air preparation equipment to improve the quality of the air.
- When using in a clean environment, please select equipment that conforms to clean-room class standards of cleanliness.



## Film Manufacturing Process Equipment

### Directional Control Valves

Intrinsically Safe Explosion-proof System 5 Port Solenoid Valve: 51-SY .....	P.2
Explosion-proof System Solenoid Valve: 50-VFE/VPE .....	P.2
5 Port Solenoid Valve: SY .....	P.2
5 Port Solenoid Valve: VQC .....	P.2
Manifold with SUP Stop Valve: SS5Y□-X460 .....	P.3

### Serial Transmission System

Serial Transmission System: EX12□/140 .....	P.4
Serial Transmission System: EX500/510 .....	P.4

### Instrumentation Equipment

Electro-Pneumatic Positioner: IP8000/8100 .....	P.4
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### Actuators

Smooth Cylinder: CQSY/CQ2Y/CM2Y/CG1Y/CA2Y .....	P.5
Low Friction Cylinder (Metal seal type): MQQ/MQM .....	P.6
Stainless Steel Cylinder: CJ5-S/CG5-S .....	P.7

### Flow Control Equipment / Related Products

Stainless Steel Speed Controller: ASG .....	P.7
Floating Joint (Stainless Steel): JS .....	P.7

### Pressure Control Equipment

Compact Electro-pneumatic Regulator: ITV0000 .....	P.8
Electro-pneumatic Regulator: ITV1000/2000/3000 .....	P.9
Precision Regulator: IR1000/2000/3000 .....	P.10
Clean Regulator: SRH .....	P.10

### Fittings / Tubings

Stainless Steel 316 One-touch Fittings: KQG .....	P.10
Stainless Steel 316 Insert Fittings: KFG .....	P.10
Clean One-touch Fittings (for Blowing): KP .....	P.10
Polyolefin Tubing: TPH .....	P.11
Soft Polyolefin Tubing: TPS .....	P.11
Fluoresin Tubing: TL/TIL .....	P.11
FEP Tubing: TH/TH .....	P.11

### Static Electricity Removal Equipment

Ionizer: IZS31 .....	P.12
Electrostatic Sensor/Monitor: IZD10/IZE11 .....	P.14

### Filters

Clean Air Module (Made to Order): LLB2 .....	P.15
Clean Air Filter: SFD .....	P.15

### Pressure Switches / Flow Sensors

High Precision Digital Pressure Switch for General Purpose: ISE50 .....	P.16
Digital Flow Switch for Air: PF2A .....	P.16
Digital Flow Switch for Water: PF2W .....	P.16
2-Color Display Digital Flow Switch: PFM .....	P.16

### Process Valves

Direct Operated 2 Port Solenoid Valve: VX2 .....	P.17
Direct Operated 2 Port Solenoid Valve for Air: VCA .....	P.17
Air Operated Chemical Valve: LVA/LVC .....	P.17

### Fluoresin Fittings

Fluoresin Fittings/Hyper Fitting: LQ1 .....	P.17
Fluoresin Fittings/Hyper Fitting Flare Type: LQ3 .....	P.17

### Process Pumps

Fluoresin Process Pump: PA/PAX/PB .....	P.18
Fluoresin Process Pump: PA/PAP .....	P.18
Process Pump: PAF .....	P.18

### Temperature Control Equipment

Thermo-cooler (Constant temperature water circulating device): HRG .....	P.18
Thermo-chiller (Constant temperature fluid circulating device <High performance type>): HRZ .....	P.18

### High Vacuum Equipment

Stainless Steel High Vacuum Angle Valve: XM .....	P.19
Stainless Steel High Vacuum In-line Valve: XY .....	P.19, 20
High Vacuum Straight Solenoid Valve: XSA .....	P.20

### Industrial Filters

Industrial Filter: FG .....	P.21
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### Pneumatic Equipment for Clean Room

Pneumatic Equipment for Clean Room .....	P.22
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### Air Levitation Rail

Air Levitation Rail .....	P.24
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### Non-contact Pad

Non-contact Pad .....	P.25
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### Technical Data

Extended Period of Continuous Valve Energization .....	P.26
Anti-ozone Equipment .....	P.27

## Intrinsically Safe Explosion-proof System 5 Port Solenoid Valve

Explosion-proof

51-SY



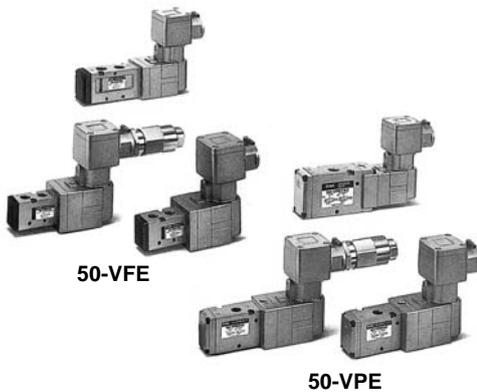
Model	Cv factor	Applicable cylinder size	Electrical entry
51-SY5000	0.90	ø63	<ul style="list-style-type: none"> <li>• Plug connector</li> <li>• Plug connector with cover</li> <li>• Terminal block (IP65)</li> </ul>
51-SY7000	1.4	ø80	
51-SY9000	2.5	ø100	
Note	For this product (system), the ExiallBT4, conforming to the newly enacted "New Engineering Standard" based on the international IEC Standard 79 – the combination of a pilot valve (solenoid valve magnet) and a barrier designated by SMC – has passed the necessary tests for a system of its type.		

## Explosion-proof System Solenoid Valve

Explosion-proof

50-VFE/VPE

Rubber seal



Model	Type	Cv factor	Power consumption (W)
50-VFE3000	5 port	1.0	3.5
50-VFE5000		2.5	
50-VPE500	3 port	2.3	
50-VPE700		4.0	
Note	Explosion-proof structure d2G4, ExdIIBT4		

## 5 Port Solenoid Valve

Rubber seal



Model	Sonic conductance: C	Applicable cylinder size	Power consumption (W)
SY3000	1.1 dm <sup>3</sup> /(s·bar)	ø40	0.35 (Standard) 0.1 (With power-saving circuit)
SY5000	2.8 dm <sup>3</sup> /(s·bar)	ø63	
SY7000	4.5 dm <sup>3</sup> /(s·bar)	ø80	
SY9000	10 dm <sup>3</sup> /(s·bar)	ø100	

SY

## 5 Port Solenoid Valve

Metal seal  
Rubber seal



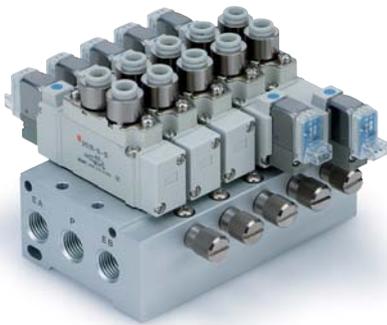
Model	Sonic conductance: C	Applicable cylinder size	Power consumption (W)
VQC1000	1.0 dm <sup>3</sup> /(s·bar)	ø40	1.0
VQC2000	3.2 dm <sup>3</sup> /(s·bar)	ø63	
VQC4000	7.3 dm <sup>3</sup> /(s·bar)	ø100	

VQC

## Manifold with SUP Stop Valve (Made to Order)

SS5Y□-X460

Supply pressure to individual parts can be turned off separately. In case of an emergency, it is possible to replace solenoid valves without cutting off the main power source.



Model		5 port valve		
		SS5Y3-X460	SS5Y5-X460	SS5Y7-X460
Applicable valve		SY3□20	SY5□20	SY7□20
Manifold style		Single base-type base mount		
P (SUP) / R (EXH) type		Common SUP, Common EXH		
Valve stations		2 to 20 stations <sup>Note)</sup>		
A, B port piping location		Valve		
Port size	P, EA, EB port	Rc1/8	Rc1/4	Rc1/4
	A, B port	M5 x 0.8 C4 (ø4 one-touch fitting) C6 (ø6 one-touch fitting)	Rc1/8 C4 (ø4 one-touch fitting) C6 (ø6 one-touch fitting) C8 (ø8 one-touch fitting)	Rc1/4 C8 (ø8 one-touch fitting) C10 (ø10 one-touch fitting)
Cv factor (Valve effective area mm <sup>2</sup> )		P→A/B 0.17 (3) C6: A/B→EA/EB 0.19 (3.5)	P→A/B 0.43 (7.8) C8: A/B→EA/EB 0.46 (8.4)	P→A/B 0.74 (13.4) C10: A/B→EA/EB 0.7 (12.7)

Note) In cases of 10 or more stations (five or more stations in case of SS5Y7), apply pressure to P port on both sides and let the air out of the EA and EB ports on both sides.

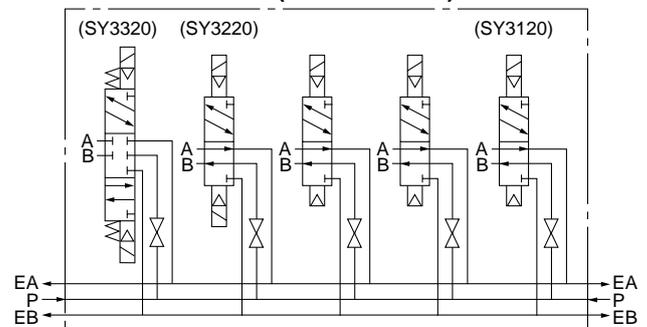
\* Please refer to P.G Information (PG97-1) for details.

- ① Improved maintenance: Individual actuators and valves can be replaced without switching off the entire system
- ② Improved "footprint": less space needed for installation
- ③ Can be equipped with a 0.1 W solenoid valve suitable for extended periods of continuous energization
- ④ The 51-SY series can be equipped with an intrinsically safe explosion-proof solenoid valve
- ⑤ Individual wiring base SS5Y7-49-□□-X167
- ⑥ Also comes with the VQ4000/5000, VFR, VFS series

### Special Orders

- Silicone grease-free specification solenoid valve
- Compatible with all types of reduced-wiring systems: CC-Link, NKE Corp., etc.

### Pneumatic Circuit (SY3000 series)



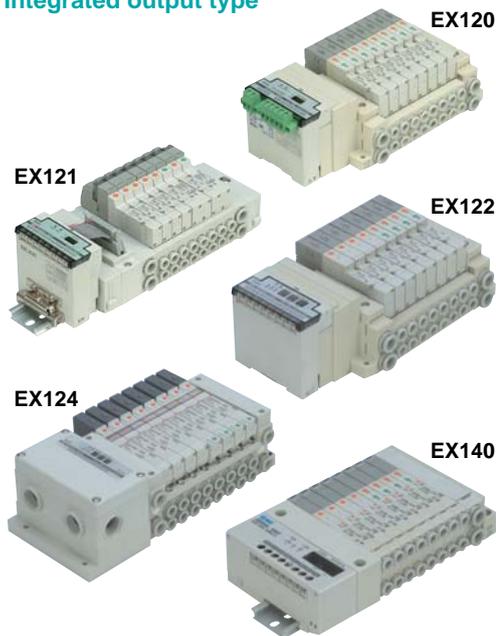
The supply stop valve is intended to stop the supply pressure temporarily. Do not use with the valve normally closed. (If it is necessary to use it with the valve normally closed, please use a blanking plate.)

## Serial Transmission System

Reduced wiring

EX

Integrated output type



Series	Enclosure	Communication protocol	Applicable valve
EX120	IP20	DeviceNet PROFIBUS-DP CC-Link	SV1000/2000/3000/4000 VQ1000/2000
EX121	IP20	JEMA Net (OPCN-1) INTERBUS Actuator Sensor interface (AS-I, ASI)	SX3000/5000 SY3000/5000 VQ1000
EX122	IP20	CAN Open Lon Works Smart Distributed System (SDS)	SX3000/5000
EX124	IP65	Mitsubishi Electric Corp. OMRON Corp. SHARP Corp. Fuji Electric Co., Ltd. Matsushita Electric Works, Ltd.	VQ2000/4000/5000
EX140	IP20	Rockwell Automation, Inc. SUNX Corp. NKE Corp.	SZ3000 SQ1000/2000

## Serial Transmission System

Reduced wiring

EX

Separated type



Series	Enclosure	Communication protocol	Applicable valve
EX500	IP65	DeviceNet PROFIBUS-DP	SV1000/2000/3000/4000 VQC1000/2000/4000/5000
EX510	IP20	CC-Link Rockwell Automation, Inc.	SY3000/5000/7000/9000 SYJ3000/5000/7000 VQZ1000/2000/3000

## Electro-Pneumatic Positioner

IP



Series	Port size	Supply air pressure (MPa)	Input current
IP8000/8100	Rc1/4	0.14 to 0.7	4 to 20 mADC
Features	IP65 Compact 13% reduction		

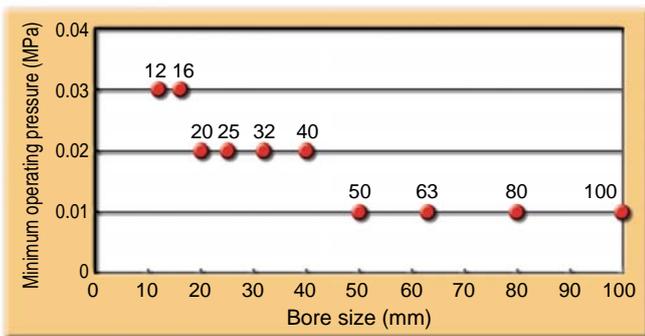
# Smooth Cylinder Tension control

CQSY/CQ2Y/CM2Y/CG1Y/CA2Y



Series	Action	Bore size (mm)	Minimum operating pressure (MPa)
CQSY	Double acting	12, 16	0.03
		20, 25	0.02
CQ2Y		32, 40	0.02
		50, 63, 80, 100	0.01
CM2Y		20, 25, 32, 40	0.02
CG1Y		20, 25, 32, 40	0.02
		50, 63, 80, 100	0.01
CA2Y		40	0.02
		50, 63, 80, 100	0.01

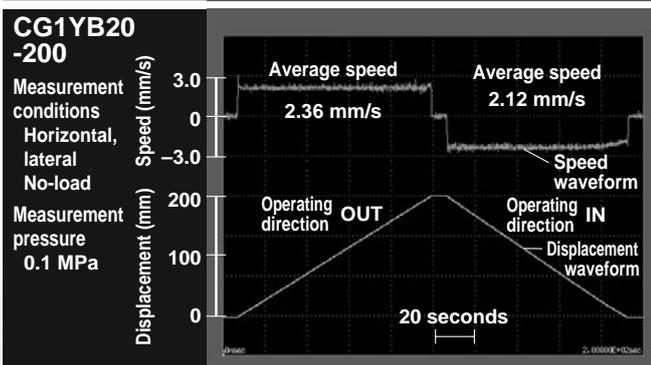
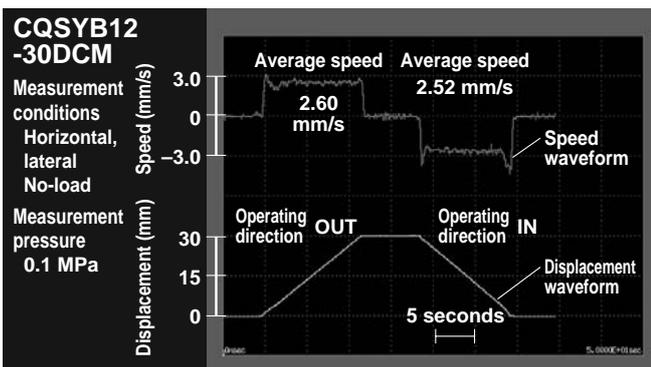
Minimum operating pressure **0.01 to 0.03 MPa**



(Measurement based on JIS B8377)

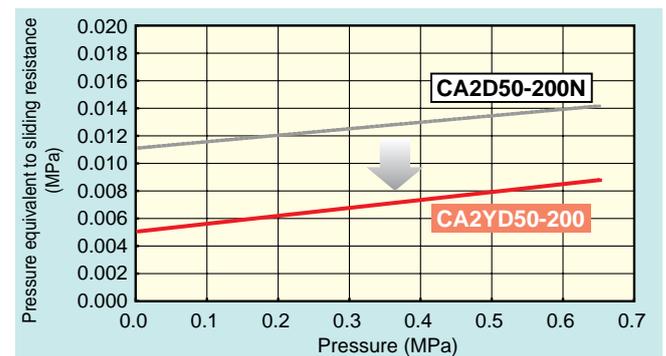
**Stable operation possible even at a low speed of 5 mm/s (Measurement based on JIS B8377)**

Smooth operation with less sticking and slipping



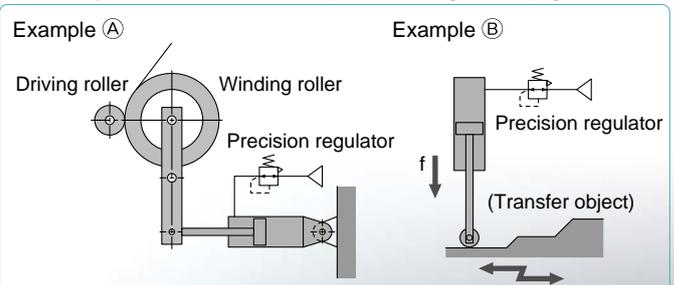
**Sliding resistance**  
**Bi-directional low-friction operation possible**

Pressure can be controlled regardless of its direction.



### Application Example

Smooth cylinder combined with precision regulator (e.g. IR series)



# Low Friction Cylinder (Metal seal type)

Tension control

MQQ/MQM



Series	Type	Bore size (mm)	Minimum operating pressure (MPa)
MQQ	Compact	10, 16, 20, 25, 30, 40	0.005
MQM	Lateral load resistance	6, 10, 20, 25	ø6: 0.02, ø10 to 25: 0.005 (MQML□□H: 0.01)

**Metal seal structure with low sliding resistance enables to cover the range of a driving speed and an output control, which were not available with the general cylinder.**

## ● Low pressure actuation

Minimal sliding resistance allows low pressure actuation at 0.005 MPa.

\* Contact SMC regarding vacuum applications.

## ● Long service life

Long service life of 10,000 km or 100 million full cycles.

## ● Low and Uniform speed actuation

Smooth, uniform speed actuation ranges as low as 0.3 mm/s.

## ● High speed, High frequency actuation

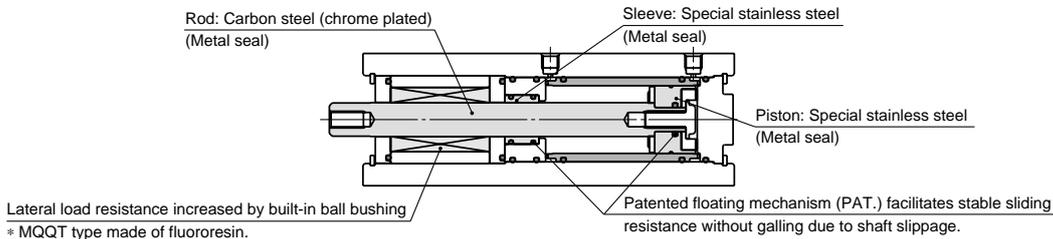
H type (without fixed orifice) achieves speeds up to 3,000 mm/s, and continuous actuation up to 50 cycles per second. (MQML□□H)

## ● Low friction

Low sliding resistance and high stability allow force control as low as 0.05 N. (Based on cylinder piston area x pressure accuracy) No increased sliding resistance after periods of non-operation.

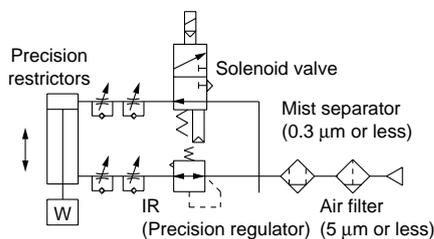
## ● Lateral load resistance

Lateral load resistance is increased by built-in ball bushing. (MQQL/MQML)



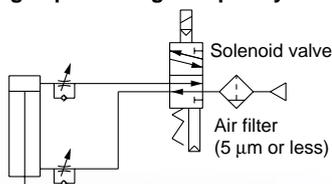
## Recommended Circuit Examples

### Example 1) Uniform & low speed actuation (no control of cylinder output)



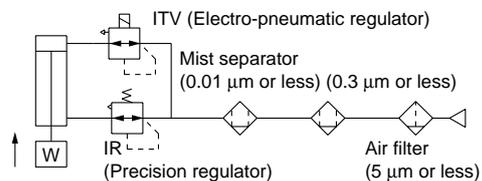
\* When using a solenoid valve, use a metal seal type (VQ, VQZ, SQ series, etc.).

### Example 3) High speed & high frequency actuation



\* When using a solenoid valve, use a metal seal type (VQ, VQZ, SQ series, etc.).

### Example 2) Low speed with output control



\* When performing control of cylinder output, do not create a restriction circuit using a speed controller, etc. Pressure inside the cylinder will drop and control will become impossible. Always control actuation by means of pressure control. When using as a pressure or tension control (external power drive), air from inside the cylinder will be expelled through the regulator relief port. If the pressure inside the cylinder is expected to rise due to deformation (stroke) or drive speed, please install an air tank between cylinders.

### Applications based on low friction specification

- 1) Operating resistance will vary with an offset load. Be sure to properly align the rod axis with the load and direction of movement when connecting. When an offset load is expected, provide a suitable mechanism such as a floating joint.
- 2) Use clean air (atmospheric pressure dew point temperature  $-10^{\circ}\text{C}$  or less). Using the AM series mist separator (nominal filtration rating of  $0.3\ \mu\text{m}$  or less), or the AM + AMD series (nominal filtration rating of  $0.01\ \mu\text{m}$  or less) is recommended.

## Stainless Steel Cylinder

Corrosion resistance

CJ5-S/CG5-S



Series	Action	Bore size (mm)
CJ5-S	Double acting	10, 16
CG5-S		20, 25, 32, 40, 50, 63, 80, 100

## Stainless Steel Speed Controller

Corrosion resistance

ASG



Series	Applicable tubing O.D. (mm)	Connection thread
ASG	4, 6, 8, 10, 12	M5, 1/8, 1/4, 3/8, 1/2
Features	Material • Metal parts: Stainless steel 316 Seal parts: Special FKM Ambient and fluid temperature: -5 to 60°C	

## Floating Joint (Stainless Steel)

Corrosion resistance

JS



Model	Series	Applicable cylinder bore size (mm)
Standard	JS	10, 15, 16, 20, 25, 32, 40, 50, 63

# Compact Electro-pneumatic Regulator

Tension control

ITV0000



Series	Port size	Set pressure (MPa)
ITV0000	Built-in one-touch fitting ø4, ø5/32	0.001 to 0.1
		0.001 to 0.5
		0.001 to 0.9
		-1 to -100 kPa
Features	Stepless control of air pressure in proportion to electric signals	

Compact **15 mm**

With a simplified high-density circuit board design, an extremely compact size has been achieved.

Lightweight **100 g**

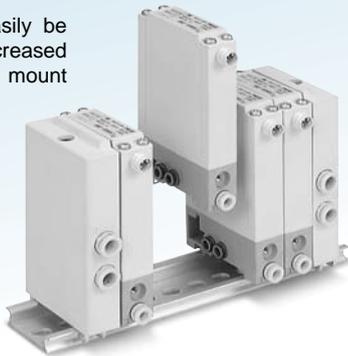
Compact electro-pneumatic regulator  
Series **ITV0000**



Actual size

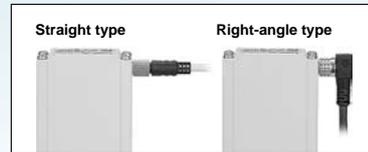
Realizes space-savings and reduction of weight for manifold use.

Stations can easily be increased or decreased due to DIN rail mount design.



### Cable connectors

Straight type and right-angle type are available.

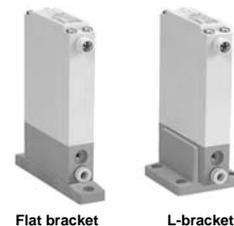


### Built-in one-touch fitting

### With error indication LED

### Brackets

Flat and L-brackets are available.

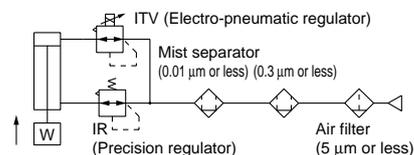


Model	Pressure range	Power supply voltage	Input signal	Output signal	Option
ITV001□	0.1 MPa	24 VDC	4 to 20 mA	Analog output	<ul style="list-style-type: none"> <li>Cable connectors Straight type Right-angle type</li> <li>Brackets Flat bracket L-bracket</li> </ul>
ITV003□	0.5 MPa		0 to 20 mA		
ITV005□	0.9 MPa	12 VDC	0 to 5 VDC	1 to 5 V	
ITV009□	-100 kPa		0 to 10 VDC		

- Equivalent to IP65
- Linearity within  $\pm 1\%$  (Full span)
- Hysteresis  $0.5\%$  (Full span)
- Repeatability  $\pm 0.5\%$  (Full span)
- High-speed response time 0.1 sec (Without load)

### High stability

Stable pressure control is possible even when a metal cylinder is used.



# Electro-pneumatic Regulator Tension control

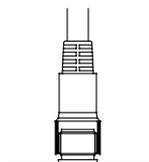
ITV1000/2000/3000



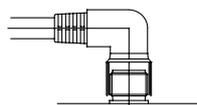
Series	Port size	Set pressure (MPa)
ITV1000	1/8, 1/4	0.005 to 0.1 0.005 to 0.5 0.005 to 0.9
ITV2000	1/4, 3/8	
ITV3000	1/4, 3/8, 1/2	
Features	Stepless control of air pressure in proportion to electric signals	

- **Air consumption  $\approx 0$   $\ell$ /min (ANR)**  
(when balanced)
- **Two types of monitor outputs**  
Analog or switch outputs can be selected.
- **Bright and easy-to-view LED display**
- **Choose from two cable connection angles.**
- **Same mounting dimensions as conventional models (IT series)**  
(Common brackets)
- **Clean-room-compatible**  
(Option)
- **Lightweight design**  
ITV2000: 350 g Weight reduced by 12% (SMC comparison)  
ITV3000: 645 g Weight reduced by 8% (SMC comparison)

Straight type

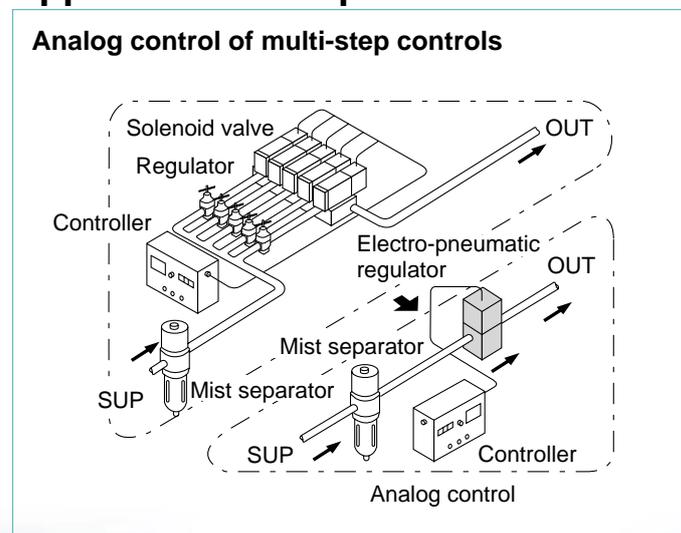


Right-angle type



- **Zero span adjustment possible in pressure-less state**
- **Equivalent to IP65**

## Application Example



## Precision Regulator

Tension control

IR1000/2000/3000



Series	Port size	Set pressure (MPa)
IR1000	1/8	0.005 to 0.2 0.005 to 0.4 0.005 to 0.8
IR2000	1/4	
IR3000	1/4, 3/8, 1/2	0.01 to 0.2 0.01 to 0.4 0.01 to 0.8
Features	Tension control, Contact pressure control Set sensitivity: Within 0.2% F.S. Repeatability: Within ±0.5% F.S.	

## Clean Regulator

Corrosion resistance

SRH



Series	Relief mechanism	Port size	Set pressure (MPa)
SRH	Non-relief	Rc1/8, 1/4, 3/8, 1/2 9/16-18UNF, 7/8-14UNF	Low pressure type: 0.01 to 0.2 High pressure type: 0.05 to 0.7
	Relief	Rc1/8, 1/4, 3/8, 1/2	
Features	Contamination controlled stainless steel regulator		

## Stainless Steel 316 One-touch Fittings

Corrosion resistance

KQG



Series	Applicable tubing O.D. (mm)	Connection thread
KQG	4, 6, 8, 10, 12	M5, 1/8, 1/4, 3/8, 1/2
Features	Material • Metal parts: Stainless steel 316 Seal parts: Special FKM Fluid temperature: -5 to 150°C Grease-free	

## Stainless Steel 316 Insert Fittings

Corrosion resistance

KFG



Series	Applicable tubing O.D. (mm)	Connection thread
KFG	4, 6, 8, 10, 12	1/8, 1/4, 3/8, 1/2
Features	Material: Stainless steel 316 Fluid temperature: -5 to 150°C Grease-free Steam can be used.	

## Clean One-touch Fittings (for Blowing)

Clean (Blow)

KP



Series	Applicable tubing O.D. (mm)	Connection thread
KP	4, 6, 8, 10, 12	1/8, 1/4, 3/8, 1/2
Features	One-touch fittings for clean room blowing systems	

### Polyolefin Tubing Clean (Blow)

TPH



Series	Applicable tubing O.D. (mm)	Color
TPH	4, 6, 8, 10, 12	Black, White, Red, Blue, Yellow, Green

### Soft Polyolefin Tubing Clean (Blow)

TPS



Series	Applicable tubing O.D. (mm)	Color
TPS	4, 6, 8, 10, 12	Black, White, Red, Blue, Yellow, Green

### Fluororesin Tubing Corrosion resistance

TL/TIL



Series	Tubing O.D.		Color
	Metric	Inch	
TL/TIL	4, 6, 8, 10, 12, 19	1/8, 3/16, 1/4, 3/8 1/2, 3/4, 1	Translucent
Features	Maximum operating temperature: 260°C (This can vary according to operating conditions.)		

### FEP Tubing Corrosion resistance

TH/TIH



Series	Tubing O.D.		Color
	Metric	Inch	
TH/TIH	4, 6, 8, 10, 12	1/8, 3/16, 1/4 3/8, 1/2, 3/4	Translucent, Black, Red, Blue
Features	Material: FEP (Fluororesin) Maximum operating temperature: 200°C (This can vary according to operating pressure.) Food Sanitation Law compliant		

# Ionizer

Static electricity

IZS31



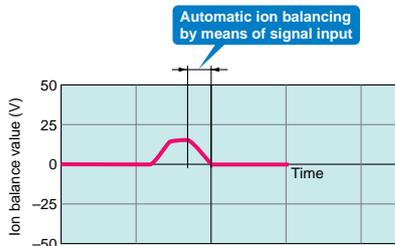
Series	Ion generation method	Applied voltage type	Output for emitting electricity	Ion balance
IZS31	Corona discharge type	Sensing DC Pulse DC DC	±7000 V	±30 V
Features	High-speed discharge (0.3 seconds) using feedback sensor Automatic adjustment of ion balance using autobalance sensor Electrode needle: Tungsten, Silicon, Stainless steel Equipped with an electrode cartridge safety mechanism and an electrode needle contamination detection function			

## Autobalance sensor

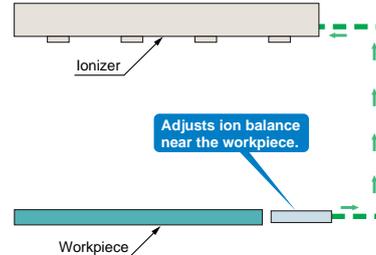
Measures the ion balance condition.

### Reduction in ion balance adjustment man-hours using an autobalance sensor

In the pulse DC mode, the ion balance can be automatically adjusted using an autobalance sensor.



The object is not affected by the height of installation or any disturbance interference since the ionizer is designed to adjust the ion balance near the autobalance sensor.



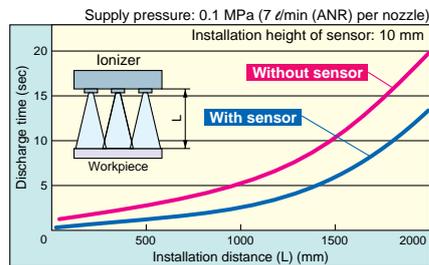
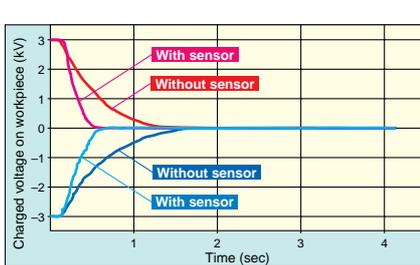
- The autobalance sensor may be connected only when adjusting the ion balance.

## Feedback sensor

Measures the polarity of a discharged object, as well as the amount of charged electricity.

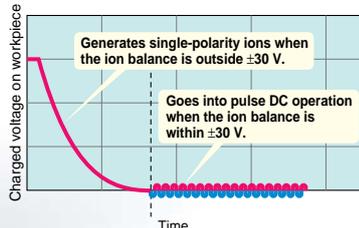
### Rapid elimination of static electricity using a feedback sensor

- The speed of static electricity removal has been increased by reading the workpiece's electrostatic potential with the feedback sensor and continuously emitting ions of a reverse polarity.



- Operation mode after static electricity removal (ion balance: within ±30 V) can be selected.  
**Energy saving run mode:** Stops generating ions after static electricity removal to reduce power consumption. Air consumption can also be reduced by controlling the pneumatic valve with a static electricity removal completion signal.  
 (Note) The pneumatic valve must separately be procured.

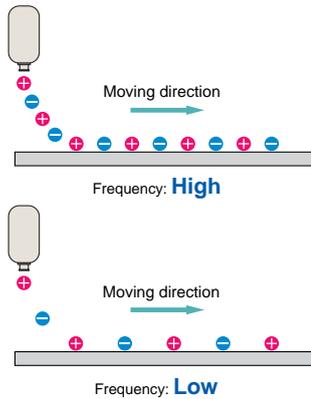
**Continuous static electricity removal run mode:** After static electricity removal, the ionizer changes to pulse DC operation and continues to remove static electricity to make it approach 0 V even if the ion balance is below 30 V.



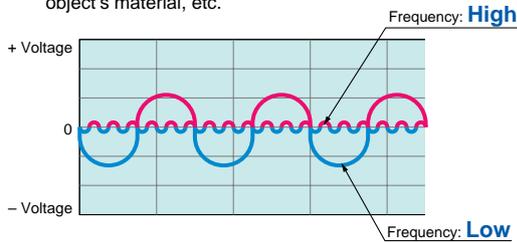
Mode	Ion emission waveform
Sensing DC Energy saving run	Stop
Sensing DC Continuous static electricity removal run	Pulse DC
Pulse DC	Pulse DC
+ charged image	Static electricity removal completed

### Switching over frequency: Max 60 Hz

- Ions are discharged at high density at workpieces moving at high speed.

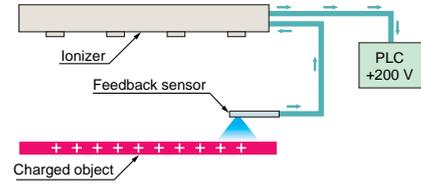


- This reduces the range of surface potential fluctuations for short installation distances after static electricity removal. Note) The range of surface potential fluctuations varies depending on the object's material, etc.



### Detects the electric potential difference and outputs in an analog voltage. (During sensing DC mode)

Outputs measured data at a 1 to 5 V level when a feedback sensor is used. By outputting the data to a PLC, etc., it is possible to control static electricity.



### Enhanced display functions

- Visualization of charging condition (During sensing DC mode)
- Visualization of ion balance (When pulse DC mode or autobalance sensor are used.)

Workpiece electric polarity	LED + OK -	Workpiece electric charge voltage	
Positive	[Red]	+400 V or higher	[Red] Light ON
	[Orange]	+100 V to +400 V	[Orange] Blinking at 4 Hz
	[Yellow]	+30 V to +100 V	[Yellow] Light ON
Static electricity removal completed	[Green]	Within ±30 V	[Green] Light ON
	[Blue]	-30 V to -100 V	[Blue] Light ON
	[Purple]	-100 V to -400 V	[Purple] Light ON
Negative	[Blue]	-400 V or lower	[Blue] Light ON
	[Grey]		[Grey] Light OFF

### Can continuously emit ions of a desired polarity. (During DC mode)

Can be used to remove static electricity from fast-charged or high-potential workpieces or to electrostatically charge them.

### Stain-detection on an electrode needle

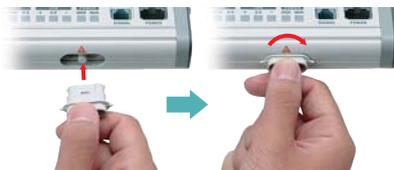
Detects electrode needle stain upon signal input and provides maintenance output signals, reducing maintenance man-hours.



Maintenance display LED light ON

### Electrode cartridge drop prevention

- Locking by double-action



- Security cover Can even more reliably prevent electrode cartridges from dropping off.



When attached to the main unit

### 3 types of electrode needle materials

- Tungsten (Ion balance: ±30 V)
- Monocrystal silicon (Ion balance: ±30 V Applicable to environments sensitive to metal contamination)
- Stainless steel (Ion balance: ±100 V)



### Made to Order

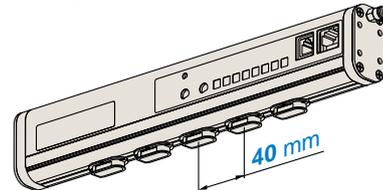
- Non-standard bar length compliant: IZS31-□□□-X10

Standard	300, 380, 620, 780, 1100, 1260, 1500, 1900, 2300
-X10	460, 540, 700, 860, 940, 1020, 1180, 1340, 1420, 1580, 1660, 1740, 1820, 1980, 2060, 2140, 2220

- Electrode cartridge 40 mm-pitch: -X15

(Supported length: 1260 mm max.)

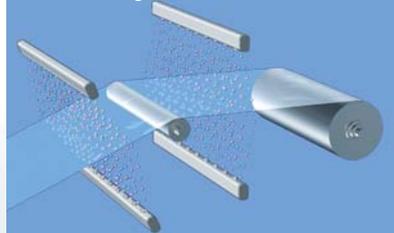
Note) Air purge nozzles are arranged at an 80 mm-pitch.



### Application Examples

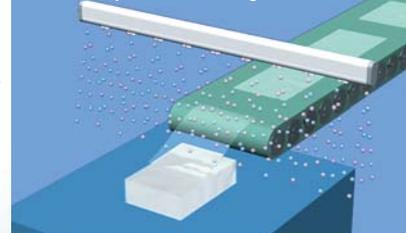
#### Eliminating static electricity on a film

- Prevents adhesion of dust.
- Prevents winding failure due to wrinkles, etc.



#### Eliminating static electricity on film mold goods

- Prevents attaching to conveyor.
- Prevents dispersion of finished goods.



## Electrostatic Sensor/Monitor Static electricity

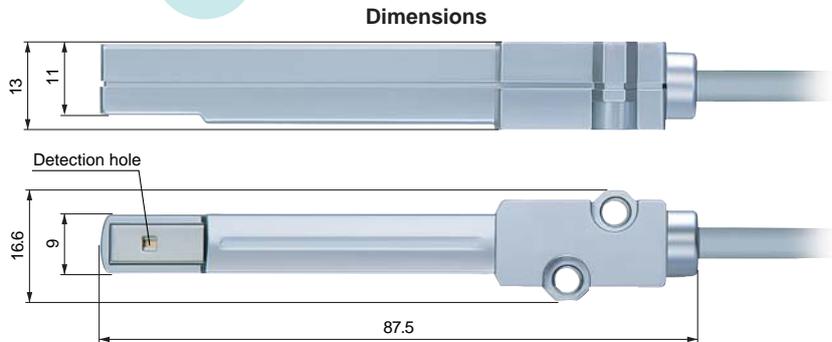
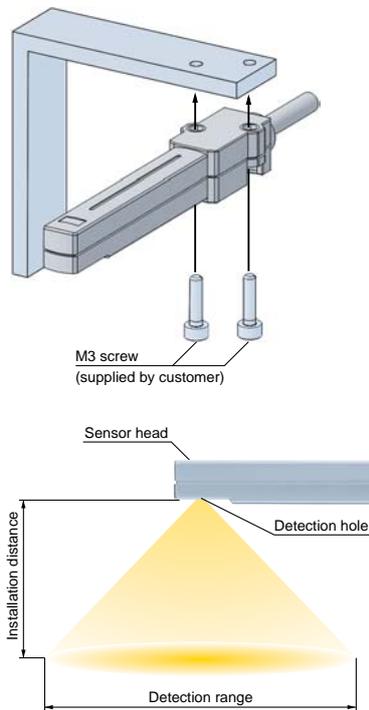
IZD10/IZE11



Series	Type	Output	Measurement/Set potential
IZD10	Sensor	Analog output 1 to 5 V	Measurement potential: $\pm 0.4$ kV (At detection distance 25 mm) Measurement potential: $\pm 20$ kV (At detection distance 50 mm)
IZE11	Monitor	Switch output x 2 Analog output 1 to 5 V 4 to 20 mA	Minimum unit setting: 0.001 kV

## Electrostatic Sensor / Series IZD10

Small and easy to mount



### Installation Distance and Detection Range

#### IZD10-110

Note 1) At measurement potential  $\pm 0.4$  kV

Installation distance (mm)	Detection range (mm)
10	45
20	85
25 <small>Note 1)</small>	100
30	120
40	150
50	180

#### IZD10-510

Note 2) At measurement potential  $\pm 20$  kV

Installation distance (mm)	Detection range (mm)
25	100
30	120
40	150
50 <small>Note 2)</small>	180
60	205
70	225
75	235

Installation distance:  
**10 to 50 mm**  
IZD10-110 ( $\pm 0.4$  kV)  
**25 to 75 mm**  
IZD10-510 ( $\pm 20$  kV)

## Electrostatic Sensor Monitor / Series IZE11

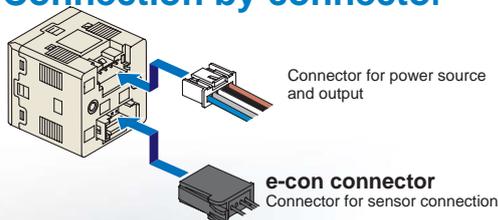
### 2-color display (Red/Green)

Able to set the display color in 4 patterns.



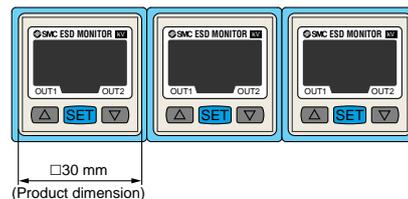
Pattern	ON	OFF
①	Red	Green
②	Green	Red
③	Red	Red
④	Green	Green

### Connection by connector



### Mountable even with a sensor touched with each other

Able to reduce the man-hour for cutting a panel.



### Functions

- Detection distance correction
- Peak/Bottom value displayable
- Key lock
- Zero-adjust
- Error display
- Switch output anti-chattering
- Connection sensor selectable

## Clean Air Module (Made to Order) Clean (Blow)

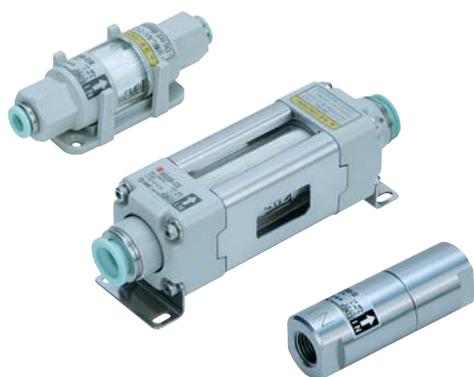
LLB2



Series	Nominal filtration rating (μm)	Measurement flow rate (l/min)	Set pressure (MPa)	Port size
LLB2	0.01	5 to 50 10 to 100	0.05 to 0.4	ø10 clean one-touch fitting
Features	A regulator, ON/OFF valve, restrictor, flow switch, and filter have been combined into a single unit. Wetted parts: Grease-free Assembled in clean room, double packing			

## Clean Air Filter Clean (Blow)

SFD



Series	Flow rate (l/min)	Case material	Type
SFD100	100	Resin	Disposable type (Irreplaceable element)
SFD200	500	Resin	Cartridge type (Replaceable element)
SFD101	100	Aluminum	
SFD102	100	Stainless steel	
Features	Built-in hollow fiber element Nominal filtration rating: 0.01 μm (Filtered particle efficiency 99.99%) Pressure drop: 0.03 MPa (Inlet pressure 0.7 MPa, Max. flow rate) Max. operating pressure: 2.0 MPa (at 20°C)		

## High Precision Digital Pressure Switch for General Purpose

ISE50



Series	Set pressure
ISE50	-0.1 to 1 MPa
Features	Possible to detect pressures of various fluids.

## Digital Flow Switch for Air

PF2A



Series	Flow range (l/min)
PF2A	1 to 12000
Features	Switch with clear LED display/Digital setting

## Digital Flow Switch for Water

PF2W



Series	Flow range (l/min)
PF2W	0.5 to 100
Features	Switch with clear LED display/Digital setting

## 2-Color Display Digital Flow Switch

PFM



Series	Flow range (l/min)	Fluid	Repeatability
PFM	0.2 to 100	Air, N <sub>2</sub> , Ar, CO <sub>2</sub>	±1% F.S. or less
Features	Compact, Lightweight Grease-free, Integrated flow adjustment valve (Reduced-wiring, space-saving) Minimum unit setting: 0.01 l/min		

## Direct Operated 2 Port Solenoid Valve

For Water, Oil, Steam, Air

VX



Series	Actuation	Port size	Orifice diameter (mmø)
VX21/22/23	N.C./N.O.	1/8, 1/4, 1/2, 3/8	2 to 10

## Direct Operated 2 Port Solenoid Valve for Air

VCA



Series	Actuation	Port size	Orifice diameter (mmø)
VCA20/30/40	N.C.	Rc1/4 to 3/4	3 to 10

## Air Operated Chemical Valve Corrosion resistance

Meeting the latest process control requirements PAT.

LV



Series		Actuation	Port size <sup>Note)</sup>	Orifice diameter (mmø)
Threaded	<b>LVA</b>	N.C./N.O./C.O.	1/8 to 1	2 to 22
Integral fitting	<b>LVC</b>	N.C./N.O./C.O.	Metric size: ø4 to ø25 Inch size: 1/8 to 1	4 to 22

Note) As for the LVC series, it shows the applicable tubing O.D.

## Fluoro-resin Fittings/Hyper Fitting Corrosion resistance

LQ1



Series	Max. operating pressure	Temperature (°C)
LQ1	0.7	0 to 150

## Fluoro-resin Fittings/Hyper Fitting Flare Type Corrosion resistance

LQ3



Series	Max. operating pressure	Temperature (°C)
LQ3	1.0	0 to 150 (Nut material: PVDF) 0 to 200 (Nut material: PFA)

## Process Pump

Explosion-proof Corrosion resistance

PA/PAX/PB

Compact pump for transfer and recovery of a wide variety of fluids



Series	Model	Operating system	Discharge flow (l/min)
PA3000 PA5000	PA3□□0	Automatically operated	1 to 20
	PA5□□0		5 to 45
	PA3□13	Air operated	0.1 to 12
	PA5□13		1 to 24
PAX1000	PAX1□12	With built-in pulsating attenuator, Automatically operated	0.5 to 10
PB1000	PB1011	With built-in solenoid valve	0.008 to 2
	PB1013	Air operated	0.008 to 0.5

## Fluororesin Process Pump

Explosion-proof Corrosion resistance

PA/PAP



Series	Material	Applicable fluid	Operating temperature (°C)	Port size (Rc·G·NPT·NPTF)
Normal environment PA3000	New PFA	IPA, Deionized water, Methyl ethyl ketone, Hypochlorous acid soda	0 to 100	PA: 3/8 female threaded PAP: 3/8 female threaded, 3/8", 1/2" tube extension
Clean room environment PAP3000				

## Process Pump

Explosion-proof Corrosion resistance

PAF



Series	Type	Material	Discharge flow (l/min)	Types of piping
PAF3410	Automatically operated	New PFA	1 to 20	Female threaded Tube extension With nut
PAF5410			5 to 45	
PAF3413	Air operated		1 to 15	
PAF5413			5 to 38	
Features	Not used for metal parts (metal-free), All fluororesin pump (PA5000)			

## Thermo-cooler (Constant temperature water circulating device)

Temperature control

HRG



Series	Temperature stability	Cooling capacity	Set temperature	Refrigerant
HRG	±1.0°C, ±0.5°C	1.1 kW, 2.3 kW, 4.8 kW	5 to 35°C	HFC407
Features	Compliant with a wide variety of industries such as semiconductor, machine tool, analytical equipment, food, printing, picture and molding machine.			

## Thermo-chiller (Constant temperature fluid circulating device <High performance type>)

Temperature control

HRZ



Series	Temperature stability	Cooling capacity	Set temperature	Refrigerant
HRZ	±0.3°C	1 kW to 8 kW	-20 to 40°C 20 to 90°C	HFC404A
Features	Types of circulating fluid: Fluorinated fluid, Ethylene glycol aqueous solution			

### Stainless Steel High Vacuum Angle Valve

High vacuum

XMA/XMC



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XMA	Air operated	Bellows seal	Single acting (N.C.)	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	16, 25, 40 50, 63, 80
XMC	Air operated	Bellows seal	Double acting	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	16, 25, 40 50, 63, 80

### Stainless Steel High Vacuum Angle Valve

High vacuum

XMD



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XMD	Air operated	Bellows/ O-ring seal	Single acting (N.C.)	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	25, 40 50, 63, 80

### Stainless Steel High Vacuum Angle Valve

High vacuum

XMH



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XMH	Manual	Bellows seal	Manual	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	16, 25, 40, 50

### Stainless Steel High Vacuum In-line Valve

High vacuum

XYA



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XYA	Air operated	Bellows seal	Single acting (N.C.)	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	25, 40 50, 63, 80

### Stainless Steel High Vacuum In-line Valve

High vacuum

XYC



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XYC	Air operated	Bellows seal	Double acting	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	25, 40 50, 63, 80

### Stainless Steel High Vacuum In-line Valve

High vacuum

XYD



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XYD	Air operated	Bellows/ O-ring seal	Single acting (N.C.)	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	25, 40 50, 63, 80

### Stainless Steel High Vacuum In-line Valve

High vacuum

XYH



Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XYH	Manual	Bellows seal	Manual	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	25, 40, 50

### High Vacuum Straight Solenoid Valve

High vacuum

XSA



Series	Valve type	Fluid	Piping	Port size
XSA	Normally closed direct operated 2 port solenoid valve	Gas that will not corrode stainless steel (equivalent to stainless steel 405)	For VCR®/ Swagelok®	1/4B, 3/8B

## Industrial Filter (Vessel type)

FGA



Series	Port size	Temperature (°C)
<b>FGA</b>	Flange: JIS 10K 1 <sup>B</sup> to 6 <sup>B</sup>	Max. 80
Features	High-flow vertical element type	

## Industrial Filter (Vessel type)

FGC



Series	Port size	Temperature (°C)
<b>FGC</b>	Flange: JIS and ANSI 1/2 <sup>B</sup> to 1 <sup>B</sup>	Max. 80
Features	High-pressure low-flow type	

## Industrial Filter (Vessel type)

FGD



Series	Port size	Temperature (°C)
<b>FGD</b>	Rc3/8, 1/2, 3/4	Max. 80
Features	Ideal for low-flow filtration	

## Industrial Filter (Vessel type)

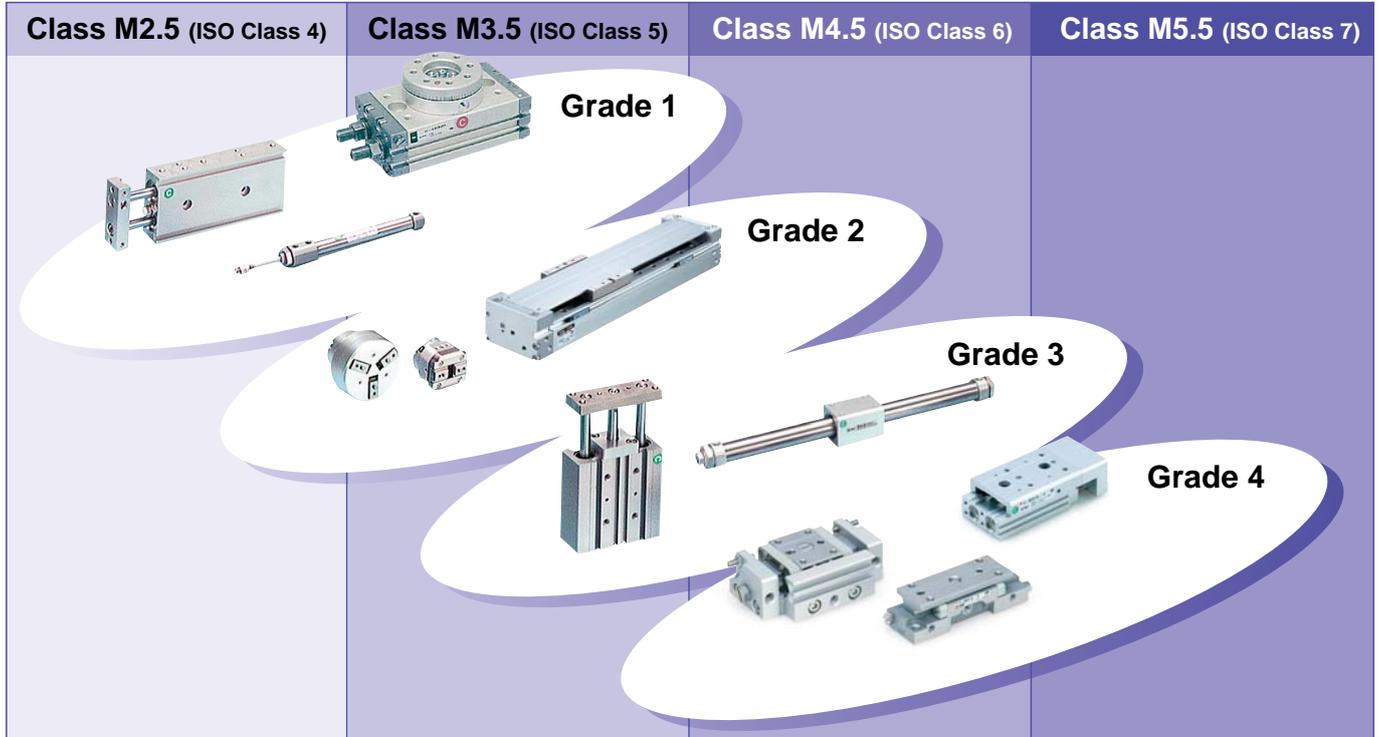
FGE



Series	Port size	Temperature (°C)
<b>FGE</b>	R1, 2	Max. 80
Features	Ideal for medium-flow filtration	

## SMC Pneumatic Equipment for Clean Room

SMC pneumatic equipment for clean room undergoes particle generation testing, and is divided into particle generation levels (Grade 1 to 4). Equipment can be selected based on the cleanliness class of the clean room.



The above illustration is a simulated image. For details on the particle generation grade of each equipment, please refer to Japanese CAT.02-23 (SMC Pneumatic Equipment for Clean Room).

### Clean Series *Series 10-/11-/12-/13-*

**Suitable for a clean environment.  
Prevents particle generation in a clean room.**

#### Applicable equipment

Actuators (Cylinders, Rotary actuators, Air grippers), Directional control equipment, Flow control equipment, Filters, Pressure control equipment, Fittings/Tubings, Air preparation equipment, Pressure switches, Clean gas filters

Note) The 11-, 12-, and 13-series are only applicable to actuators.

### Special Clean Series

**Adheres to an even higher standard of cleanliness than the Clean Series.  
The development of this line of products, from structure and materials to assembly environment, are all determined for clean environment use.**

#### Applicable equipment

Clean rodless cylinders, Clean regulators, Clean one-touch fittings, Clean tubings, Clean gas filters

### Copper, Fluorine, Silicon-free, Low-particle Generation *Series 21-/22-*

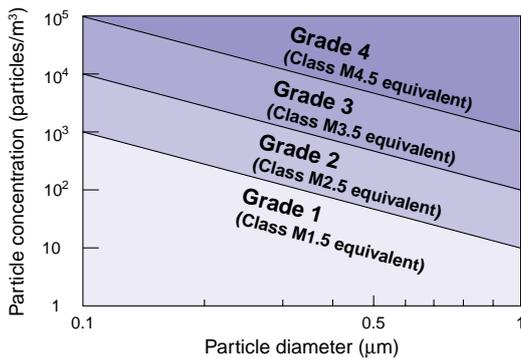
**Suitable for environments where the presence of copper, fluorine or silicon materials is restricted.  
Structures are identical to the Clean Series** (Grease and packaging configurations are different from the Clean Series.)

#### Applicable equipment

Actuators (Cylinders, Rotary actuators, Air grippers), Directional control valves, Flow control equipment, Pressure control equipment, Fittings

Note) The 22- series is only applicable to actuators.

**Classification Grade of Particle Generation**



**Cleanliness Grade**

SMC	Fed.Std.209E	ISO 14644-1
	SI unit	
Grade 1	M1.5	ISO Class 3
Grade 2	M2.5	ISO Class 4
Grade 3	M3.5	ISO Class 5
Grade 4	M4.5	ISO Class 6
	M5.5	ISO Class 7
	M6.5	ISO Class 8

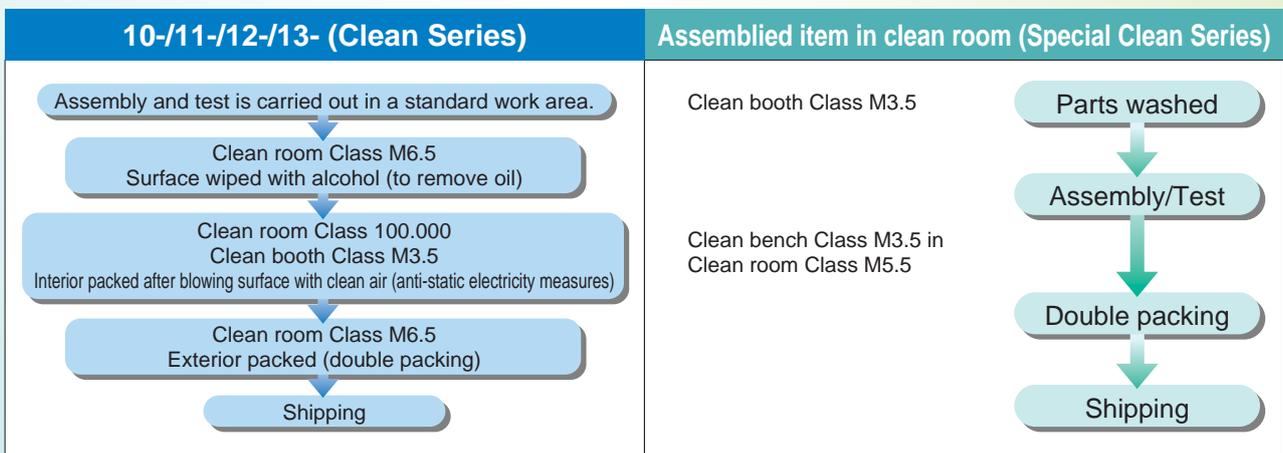
Grading is based on SMC's original system of designation, with a lower grade number indicating a smaller volume of particle generation. The information in parentheses indicates the upper limit of concentration for the cleanliness classes based on Fed.Std.209E-1992.

(For further details, please refer to front matter 23 "Particle generation measurement method" and front matter 24 "Specification comparison regarding cleanliness" in Japanese CAT.02-23, SMC Pneumatic Equipment for Clean Room.)

Note) In case of the one-touch fitting 10-KQ (that includes built-in one-touch fitting solenoid valve manifolds, and speed controllers with one-touch fittings), changes in internal pressure may cause the collet chuck to slide very slightly. This may result in particle generation, so please avoid using this item in Grade 1 or Grade 2 areas. However, there is no need for similar caution in the case of insert fittings (KF), miniature fittings (M, MS), clean one-touch fittings (KP, KPQ, KPG), or speed controllers with clean one-touch fittings (AS-FPQ/FPG).

**Dust is kept from the clean room.**

- After inspection, the product is blown with high purity air (of Class M3.5 clean bench) in a clean environment.
- Products are sealed and shipped in anti-static double bags.

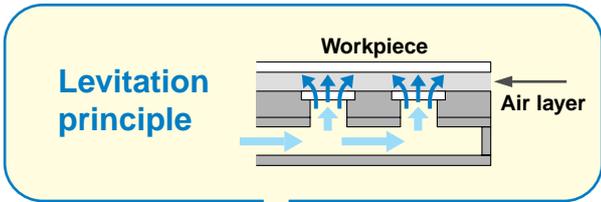


The 21- and 22-series are given standard wrapping (assembly, test, packing, and shipping carried out in a standard work area.)  
When clean wrapping is required, please contact SMC.

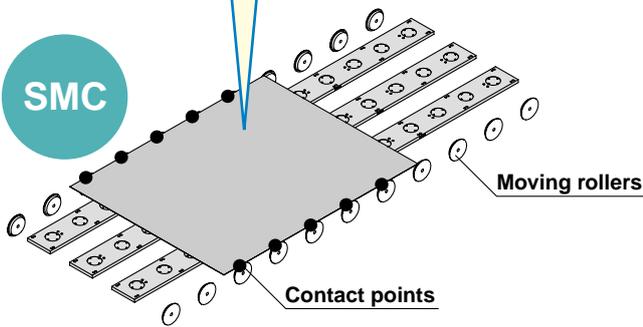
**Air Levitation Rail** Made to Order

**Non-contact process prevents deflection and vibration of work.**

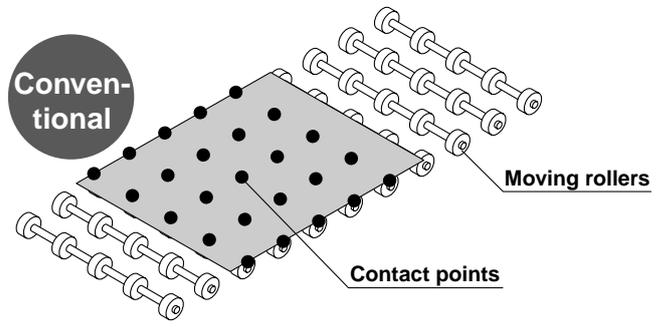
- With non-contact technology (air layer), damage to or contamination of work can be prevented. (Illustration shows contrast with conventional models.)



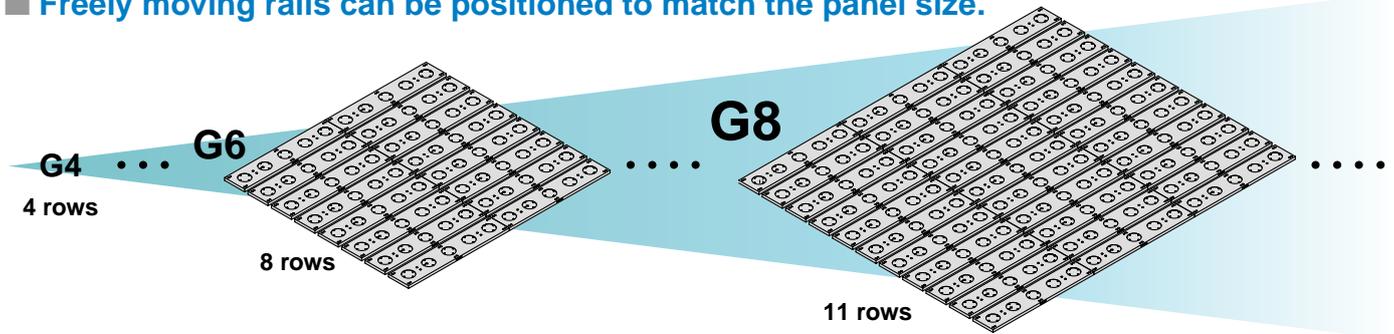
**SMC**



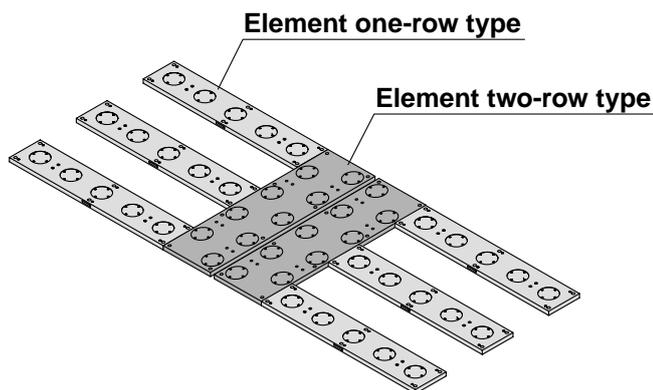
**Conventional**



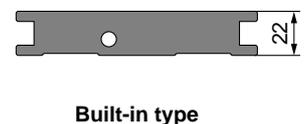
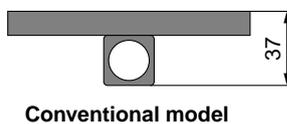
- Freely moving rails can be positioned to match the panel size.



- Porous element (Stainless steel 316L) unitized into the shape of a rail.
- Applicable to clean environment (Class 100)
- Specially coated rail parts reduce scratches and contamination adherence on the workpieces that might be caused by pressure drops. (Option)



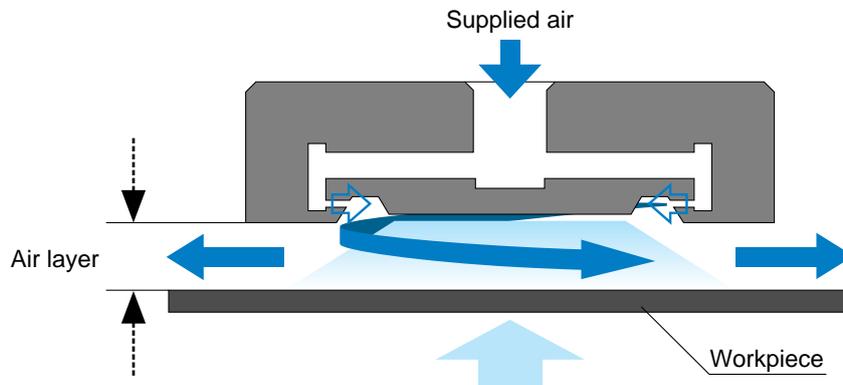
- Levitation accuracy: **±0.05 mm**
- Overall height reduced by **40%** (compared with conventional models)
- Reverse-side convex portion (air tank) integrated



Non-contact Pad

Made to Order

Suction of workpiece with non-contact process

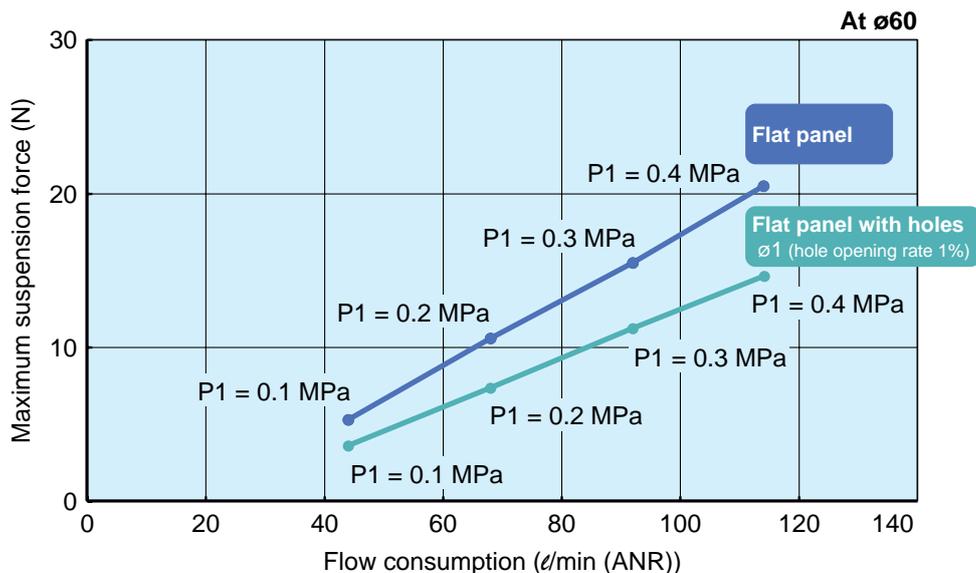


**[Operating principle]**

Clean air introduced from the supply port is expelled from the nozzle on the side of the cylindrical portion, and rotational air flow generates a vacuum inside the cylindrical portion ("cyclone effect").

The supplied air is blown out into the atmosphere from the space between the adsorption surface and the workpiece, and the negative pressure generated by this air and the cyclone effect is balanced against the weight of the workpiece. The air layer generated through this process suspends the workpiece with no points of contact.

- High suspension force created by cyclone method: **20 N** (supply pressure 0.4 MPa)
- Space between adsorption area and workpiece: **0.1 mm or more**



## Extended Period of Continuous Valve Energization

If a valve will be continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil. This will likely adversely affect the performance of the solenoid valve and any nearby peripheral equipment. Therefore, when it is continuously energized or the energized period per day is longer than the de-energized period use, read the precautions below and take appropriate measures. (Please consult SMC for the number of valves energized and the value of the rise in temperature.)

### ■ Precautions

- ① When the valve is mounted within the control panel, please take heating measures to maintain a temperature within the range listed in the valve specifications (−10 to 50°C).
- ② Especially when simultaneously keeping three or more stations of manifolds in a row energized continuously for extended periods of time, or simultaneously keeping the A side and B side of dual 3 port valves energized continuously for extended periods of time, there can be drastic rises in temperature. Please exercise caution.
- ③ Do not keep latching-type valves energized continuously.  
Because latching-type valves, such as double solenoid valves, maintain their switching position when energized for a split second (20 ms or more), it is not necessary to keep them continuously energized. (Please consult SMC in cases where it is necessary to keep latching-type valves energized continuously for extended periods of time.)

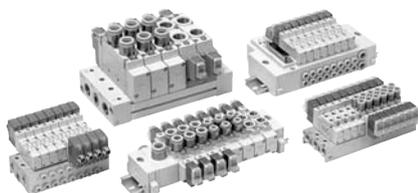
### ■ Measures

- ① Please use low-power-consumption solenoid valves. Recommended models are shown below.

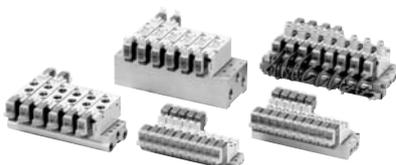
#### Series SY/VQZ

- Power consumption **0.35 W**: 24/12/6/5/3 VDC  
**0.1 W** (With power-saving circuit): 24/12 VDC

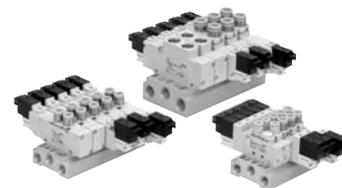
SY3000/5000/7000/9000



SYJ3000/5000/7000



VQZ1000/2000/3000

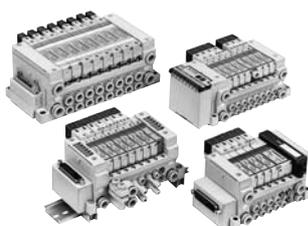


0.1 W (with power-saving circuit) is not available for the VQZ1000/2000/3000.

#### Series VQ/SQ/VQC

- Power consumption **0.5 W** (Low-wattage type): 24/12 VDC  
**0.3 W** (With power-saving circuit): 24/12 VDC (compliant with the SQ)

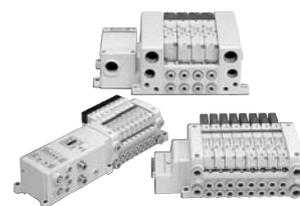
VQ0000/1000/2000/4000



SQ1000/2000



VQC1000/2000/4000



When selecting solenoid valves, please take other specifications into consideration besides power consumption. Valves with power-saving circuits or low-wattage types may have maximum operating pressures, response times, etc. that differ from the standard. Please refer to the catalog for each series for details.

- ② Please consider changing to an N.O. (Normally Open) air circuit so that air can escape during non-energized periods.

## Anti-ozone Equipment

Equipment variations – improved resistance to ozone through use of different rubber materials, etc.

### ● What troubles may occur?

The rubber materials (generally NBR) used in pneumatic equipment may crack depending on the concentration of ozone, and it leads to undesirable situations such as air leakage and malfunction.

#### Types of Damage and Malfunctions

Device	Damaged parts	Phenomenon
Regulator	Diaphragm 	<ul style="list-style-type: none"> <li>• Constant air leakage from bleed hole</li> <li>• Unable to adjust pressure</li> </ul>
	Main valve seat	<ul style="list-style-type: none"> <li>• Constant air leakage from bleed hole</li> <li>• Unable to adjust pressure</li> </ul>
Speed control valve	Valve seat rubber for check valve Check valve seal 	<ul style="list-style-type: none"> <li>• Unable to adjust flow</li> </ul>
Solenoid valve	Main valve seal 	<ul style="list-style-type: none"> <li>• Air leakage, malfunction</li> </ul>
	Gasket	<ul style="list-style-type: none"> <li>• Air leakage, malfunction</li> </ul>
Cylinder (Actuator)	Seals are coated with lubricating grease, so deterioration due to ozone may not be observed. The lubricated type offers the same effect using oil seals. Even with non-lube types, grease is replenished to protect the seals. Therefore, they do not deteriorate.	

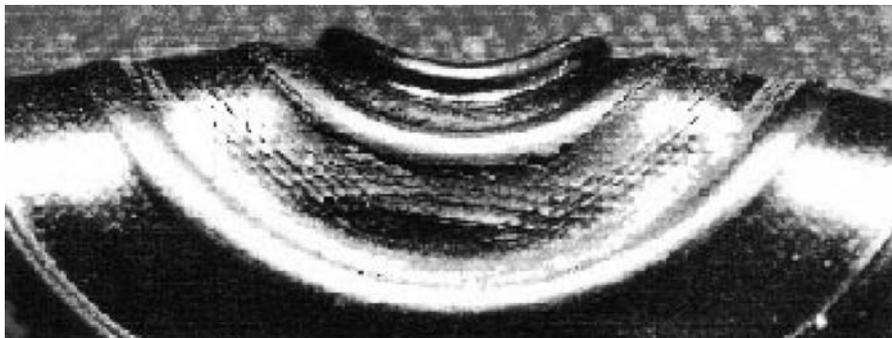


Photo 1 Cracking of diaphragm



Photo 2 Cracking of check valve seal

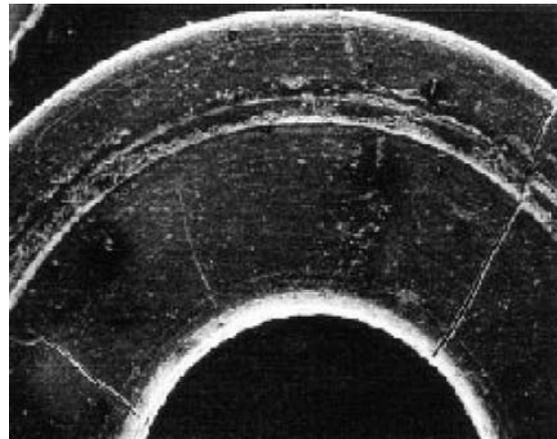


Photo 3 Cracking of main valve seal

## Anti-ozone Equipment

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- **Anti-ozone measures consist of the following three measures.**

### **1 Standard**

This is sufficient for standard anti-ozone measures. It is available for low-concentration ozone environments (0.03 ppm or less).

### **2 80-Series (Made to Order)**

Products with an “80-” at the beginning of the part number of the product are available for anti-ozone measures.  
Example: **80**-VK3140-5G-01

### **3 Special orders**

Equipment is available on special order. Please contact SMC for details.

## Solenoid Valves

### 1 Standard

Description	Series
4/5 Port Solenoid Valve	SJ2000/3000
	SV1000/2000/3000/4000
	SZ3000
	SY3000/5000/7000/9000
	SYJ3000/5000/7000
	SX3000/5000/7000
	VQC1000/2000/4000
	SQ1000/2000
	VQ0000/1000/2000
	VQ4000
	VQ5000
	VQZ1000/2000/3000
	VQD1000
3 Port Solenoid Valve	V100
	SY100
	SY300/500
	SYJ300/500/700
	VQ100
VQZ100/200/300	
Large Size 5 Port Solenoid Valve	VP4□50/4□70
Large Size 3 Port Solenoid Valve	VP3145/3165/3185
Air Operated Valve	VPA3145/3165/3185
	SYA3000/5000/7000
	SYJA3000/5000/7000
	VPA4□50/4□70
	SYJA300/500/700
Hand Valve	VH
Pressure Release 3 Port Valve	VHS20 to 50
Silencer	AN
	AMC

### 2 80- Series

Description	Series
4/5 Port Solenoid Valve	VK3000
	VZ1000/3000/5000
	VF1000/3000/5000
	VQ7-6/7-8
	VP7-6/7-8
	VPN-6/-8
	VFR2000 to 6000
3 Port Solenoid Valve	VK300
	VKF300
	VZ100/300/500
	VT307/317
	VT301/315/325
	VP300/500/700
	VG342
VS3115/3110/3135/3145	
Air Operated Valve	VFA3000/4000/5000
	VFRA3000/5000
	VT301/315
VPA300/500/700	
Mechanical Valve	VM, VZM, VFM
Relay Valve	VR2110
	VR1210/1220
	VR3200/3201
	VR3100/3110
Pressure Release 3 Port Valve	VHS40□
	VHS50□
	VHS2000 to 4000
VHS2500 to 4500	
Multi-functional Valve	VEX1
	VEX3

\* Special order depending on models.

### 3 Special Orders

Description	Series
4/5 Port Solenoid Valve	VFR2000/6000*
	VFS1000/6000*
	VS4□10
3 Port Solenoid Valve	VZ200/400
Air Operated Valve	VZA2000/4000
	VSA4□20/4□30/4□40
	VZA200/400
Large Size 3 Port Solenoid Valve	VGA342
Finger Valve	VHK
Multi-functional Valve	VEX5*
3 Port Solenoid Valve	VKF300

\* 80- are only available for specific part numbers.

## Vacuum / Flow Control Equipment

### 1 Standard

Description	Series
Vacuum Ejector	ZX
	ZU
	ZQ
	ZMA
	ZM
	ZH
Suction Filter	ZFC
	ZFB
	ZFA
Drain Separator for Vacuum	AMJ
Speed Controller	ASD□□□-F-T
	ASD□□□-F-D
	ASD
	AS□2□0-T
	AS□2□0-D
	AS□□□F (One-touch)
	AS□□□1F-T
	AS□□□1F-D
	AS□□□1F-3
	AS□□□□M
	AS□□□□FM
	AS□□□□FG
	AS□□□□FE
	AS□□□□E
	AS□2□1FPQ
	AS□2□1FPG
	AS (Metal elbow type)
	AS Uni type
	ASP
	Exhaust Controller
Metering Valve	ASN2
Quick Exhaust Valve	AQ□□□F
Air Saving Valve	ASR, ASQ

### 2 80- Series

Description	Series
Vacuum Ejector	ZR
Quick Exhaust Valve	AQ
Check Valve	AKH
	AKB
	AK
Speed Controller	AS (Large volume, metal in-line type)
	AS (Metal in-line type)

### 3 Special Orders

Description	Series
Vacuum Ejector	ZL
Safety Speed Control Valve	ASS (SSC)
Vacuum Ejector	ZYY, ZYX
Vacuum Pad*	ZP, ZPT, ZPTX
Cylinder for Vacuum*	ZCUK

\* As the special order varies according to pad materials, consult SMC.

## Air Line Equipment / Piping Equipment

### 1 Standard

Description	Series
Filter	AF□□
	AFM□□
	AFD□□
Clean Gas Filter	SF
Regulator	AR□□
	AR□□K
	ARG□□
	ARG□□K
Lubricator	AL□□
Filter Regulator	AW□□
	AW□□K
	AWG□□
	AWG□□K
	AWM□□
	AWD□□
Filter	AF800/900
Regulator	ARJ
	AR□25/□35
Manifold Regulator	ARM
	ARM5
	ARM10/11
Air Combination	ACG□□
Precision Regulator	ARP3000
Clean Regulator	SRP1000
Spacer Regulator	ARBYJ5000/7000 ARBQ4000/5000
MR Unit	AMR
Soft Start-up Valve	AV5000
Blow Gun	VMG
Amplifier for Electro-pneumatic Proportional Control Valve	VEA
Pressure Gauge	G□
	G46E
	G49
	G46-□-□-SRA, B
	GP46
	GS40
	PPA
Lubricator	AL800/900
Lubrication Equipment	ALF
	ALT
	ALD
	ALB
Fitting	KJ
	KQ2, KQ2 Uni
	KS, KX
	KM
	KF
	M
	H, D, L, LL
	KC
	KK
	KK13
	KKA
	KKH
	DM
	KDM
	KB
	KR
	KRM

Description	Series
Fitting	KG
	KA
	MS
Tubing	T□
	TKS, TM, TMA, TK, TG
Air Tank for Booster Regulator	VBAT05A/10A/20A/38A
	VBAT05S/10S/20S/38S

### 2 80- Series

Description	Series
Precision Regulator	IR1000/2000/3000
	VEX1□30/1□33
Electro-pneumatic Regulator	ITV0000
	ITV0000
	ITV2000/3000
	ITV209□
Booster Regulator	VBA
Soft Start-up Valve	AV2000/3000/4000
Vacuum Regulator	IRV1000/2000/3000

### 3 Special Orders

Description	Series
Lube Unit	AU
Regulator	ARX20
Electro-pneumatic Proportional Control Valve	VEF, VEP
	VER2000/4000
Electro-pneumatic HYREG®	VY1

## Detection Equipment / Air Preparation Equipment

### 1 Standard

Description	Series
Pressure Switch	ZSE30, ISE30
	ZSE40, ISE40
	PSE510
	PSE530
	PSE540
	PSE550
	PSE560
	ZSE4□D, ISE4□D
	ZSE5B, ISE5B
	ZSE6B, ISE6B
	ZSE3, ISE3
	PS1000
	ZSE1, ISE1
	ZSE2, ISE2
	ZSP1
	IS1000
IS3000	
ISE70, ISE75(H)	
ISE35	
Air Catch Sensor	ISA
	ISA2
Pressure Switch	IS2761
	ISG
Flow Switch	ZSM1
	PF2A
	IFW5
Aftercooler	IF3
	PFM7
	HAA
Air Tank	HAW
	AT
Dryer	IDU, IDF
	ID
	IDG
Water Separator	AMG
	AFF
Filter	AM
	AMD
	AMH
	AME
	AMF
	AD402/600
Auto Drain Valve	ADM200
	ADH4000
	GD40-2-01

## Fluid Control Equipment

### 1 Standard

Description	Series
2/3 Port Solenoid Valve	VCA
	VCB
	VCL
	VCS
	VCW
	VQ20/30
	VXR2
VND	
Fluororesin Equipment	LV
	LQ
	TL, TIL
Process Pump	PA(P)33
	PAF

### Options\*

Description	Series
2/3 Port Solenoid Valve	VDW10/20/30
	VDW200/300
	VX2
	VXD2
	VXP2
	VX3
	VXA
	VXZ
	VXH
	VXF
VNA	
Process Valve	VNB
	VNC
	VNH
	SGC

\* Please select fluoro-rubber seal as an option.

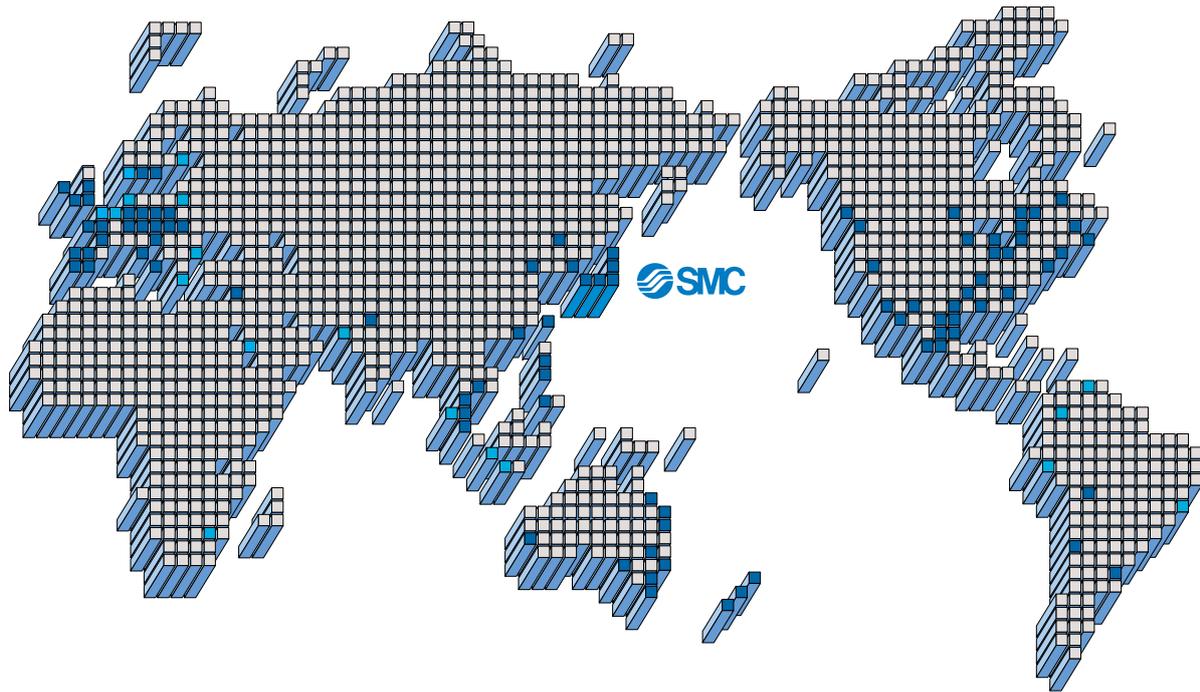
### 3 Special Orders

Description	Series
Process Pump	PA
	PAX
	PB





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